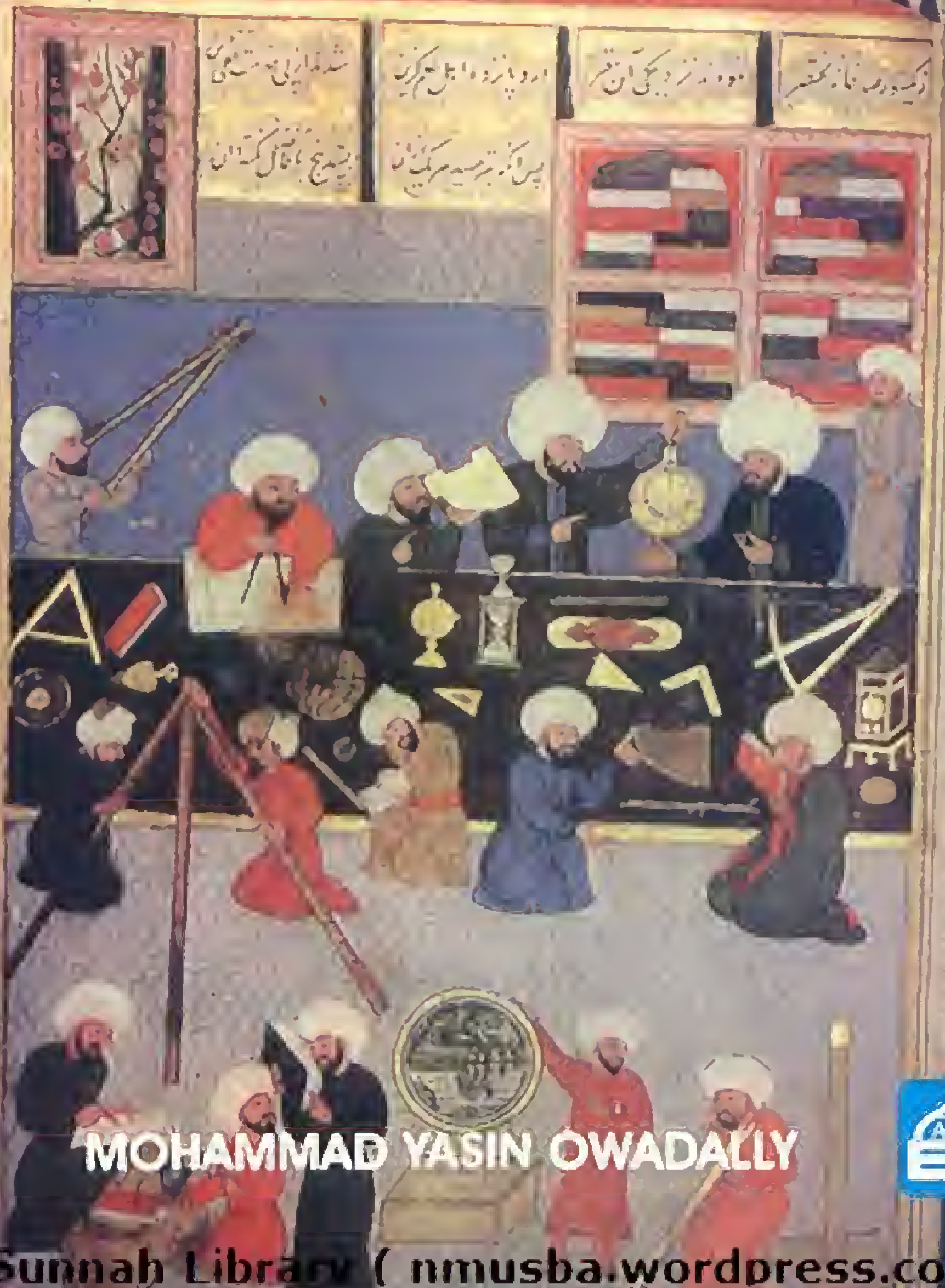


# THE MUSLIM SCIENTISTS



MOHAMMAD YASIN OWADALLY





*"Read: In the name of your Lord Who Created  
(the universe). Created man from a clot of  
Congealed blood. Read: your Lord is the Most  
Bountiful One. Who, by the pen, taught man what  
he did not know"*

(Surah Al-Alaq 96 :1-5)

These words of Allah have produced Muslim Scientists who had contributed enormously to the colossal technology of today. Computer is genius work of mathematics. The world must thank Al-Khwarizmi, an Arab mathematician, whose Contributions had enabled this Wonderful machine to be produced. Muslim scientists had made a lot of scientific discoveries. They have excelled in Geometry, Algebra, Astrology, Astronomy, Surgery, Zoology, Geography, Cosmology, Medicines, Agriculture, Pharmacology, (Chemistry), Physics, Alchemy Botany, Geology, Mineralogy, Architecture and many others. Muslim scientists were the Pioneers in all these important fields. The westerners later used the Muslim scientists' discoveries for their study. In fact, there were no fields that Muslim scientists had not penetrated. This book gives some snapshots of our major Muslim Scientists' Contributions to the world.

ISBN 983-065-100-2

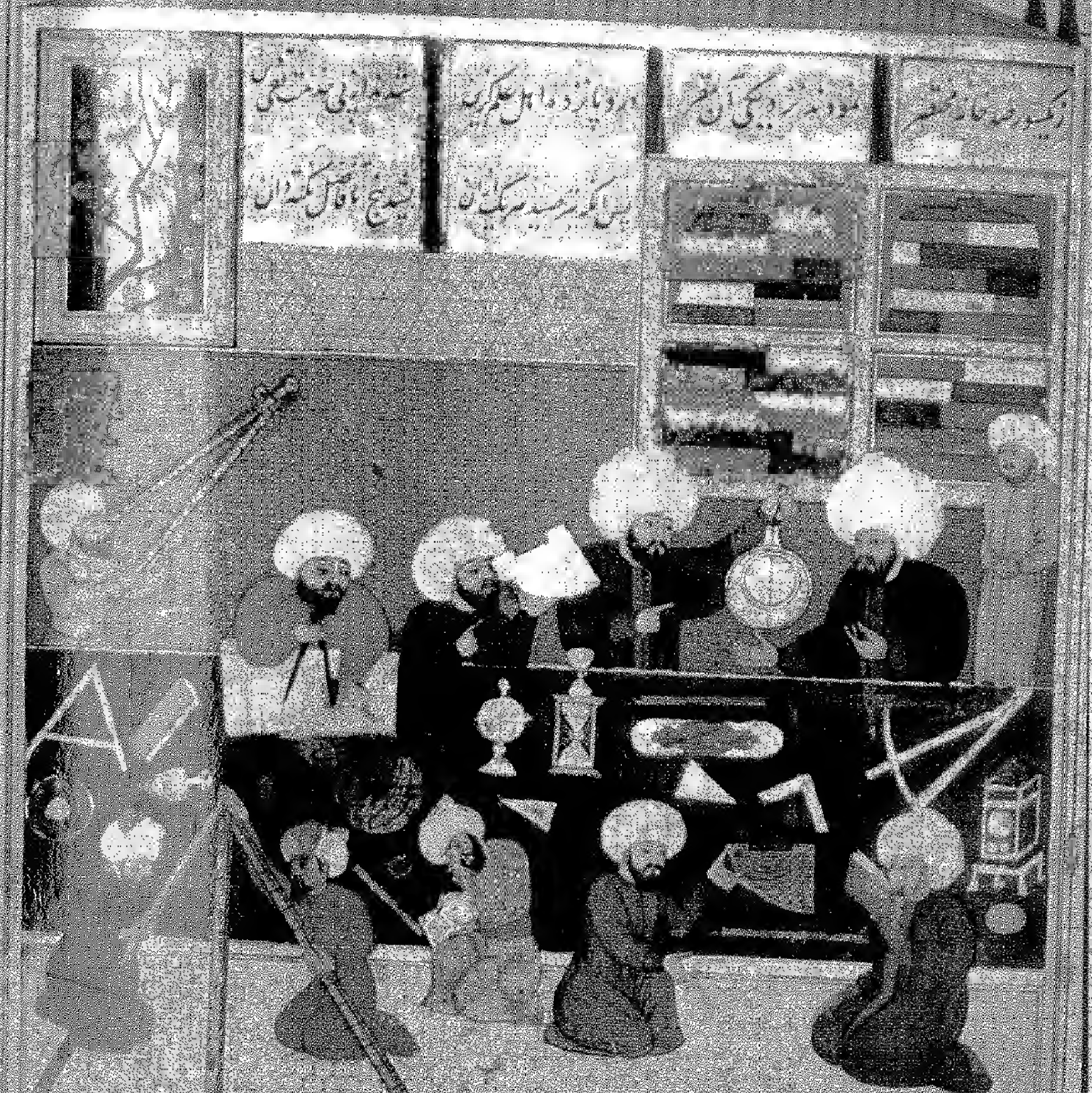


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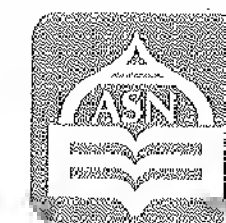


# THE MUSLIM SCIENTISTS

Mohamad Yasin Owadally

Edited by  
Abu Tahir

Published by



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A.S. NOORDEEN

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First Published 1424/2003

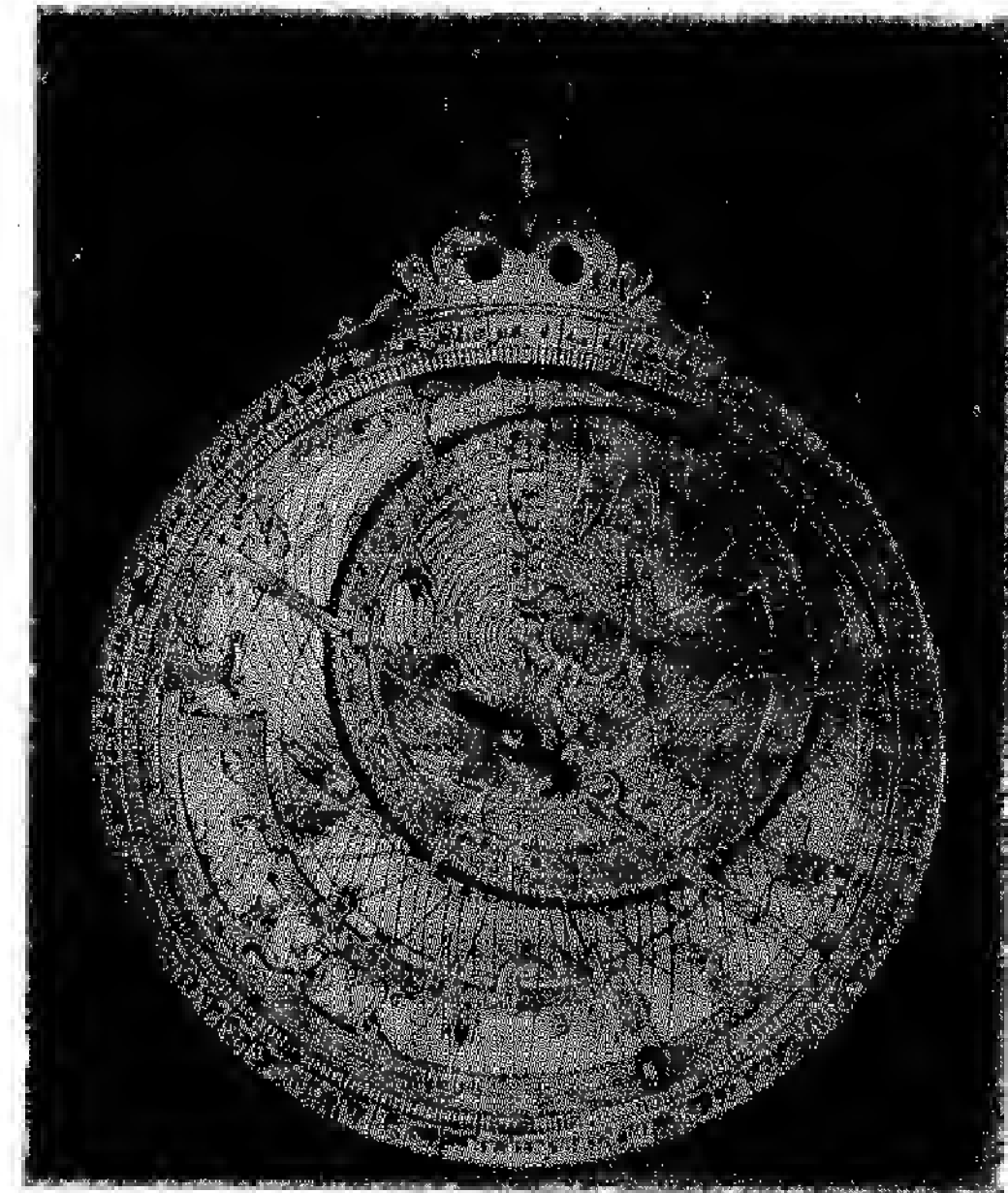
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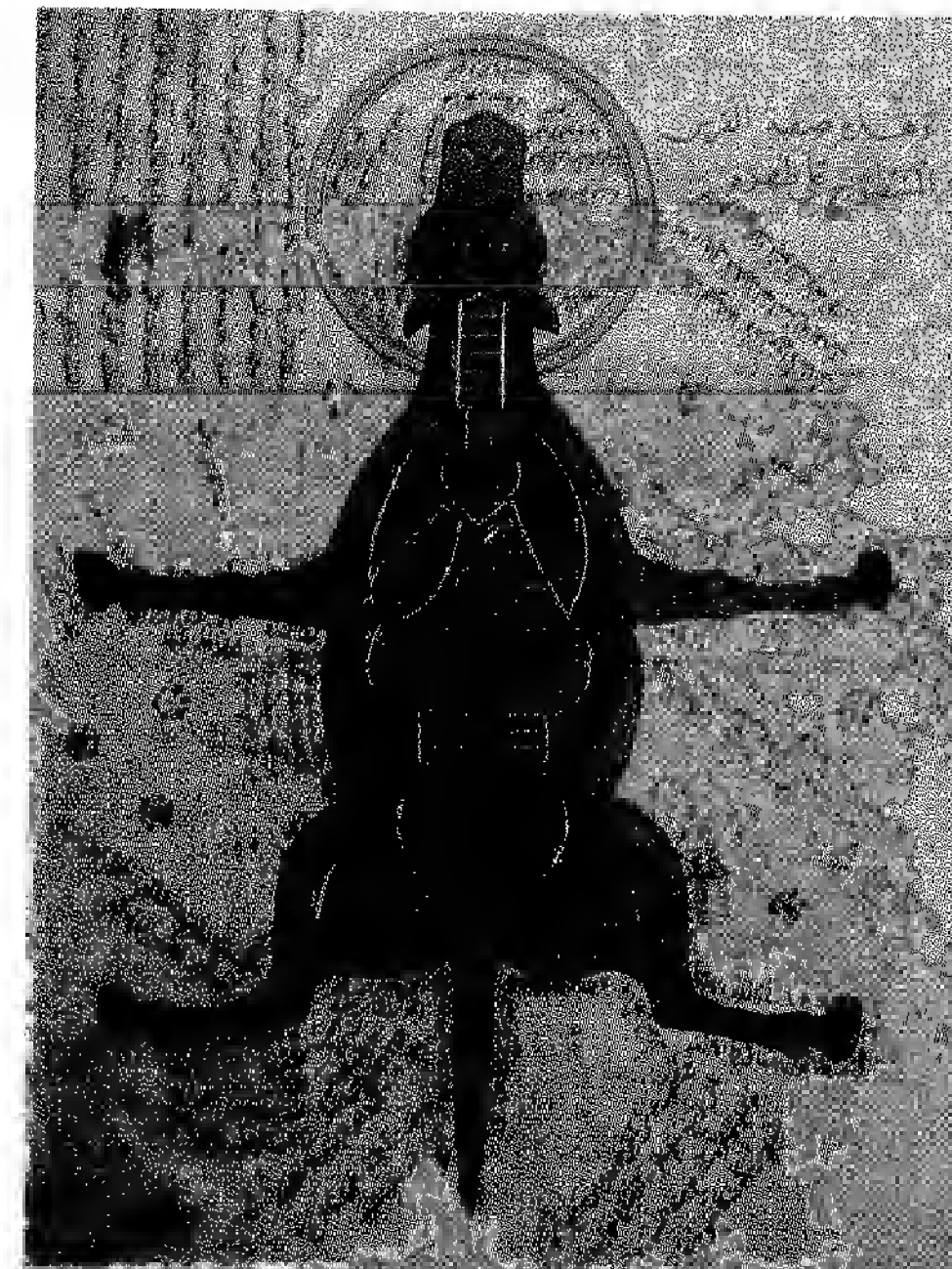
ISBN 983-065-100-2

Published by  
**A.S. NOORDEEN**  
G.P.O.Box 10066,  
50704 Kuala Lumpur  
Tel: 40236003  
Fax: 40213675  
e-mail: asnoordeen@yahoo.com  
holybook@tm.net.my  
www.asnislamicbooks.com

Printed by  
Percetakan Zafar Sdn. Bhd.  
Kuala Lumpur

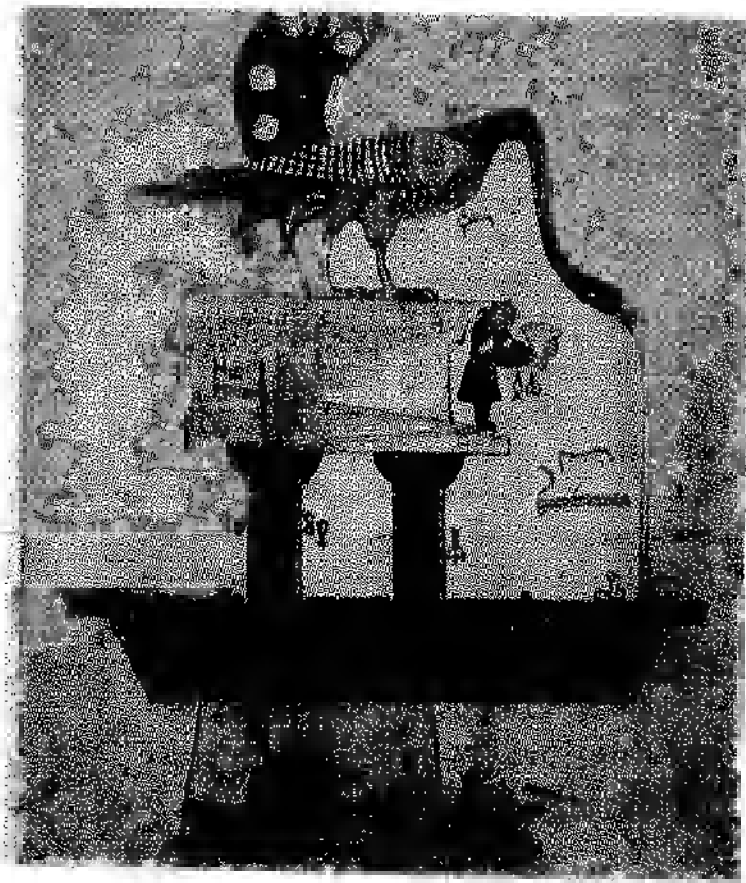


*Astrolabes from the Islamic world.*

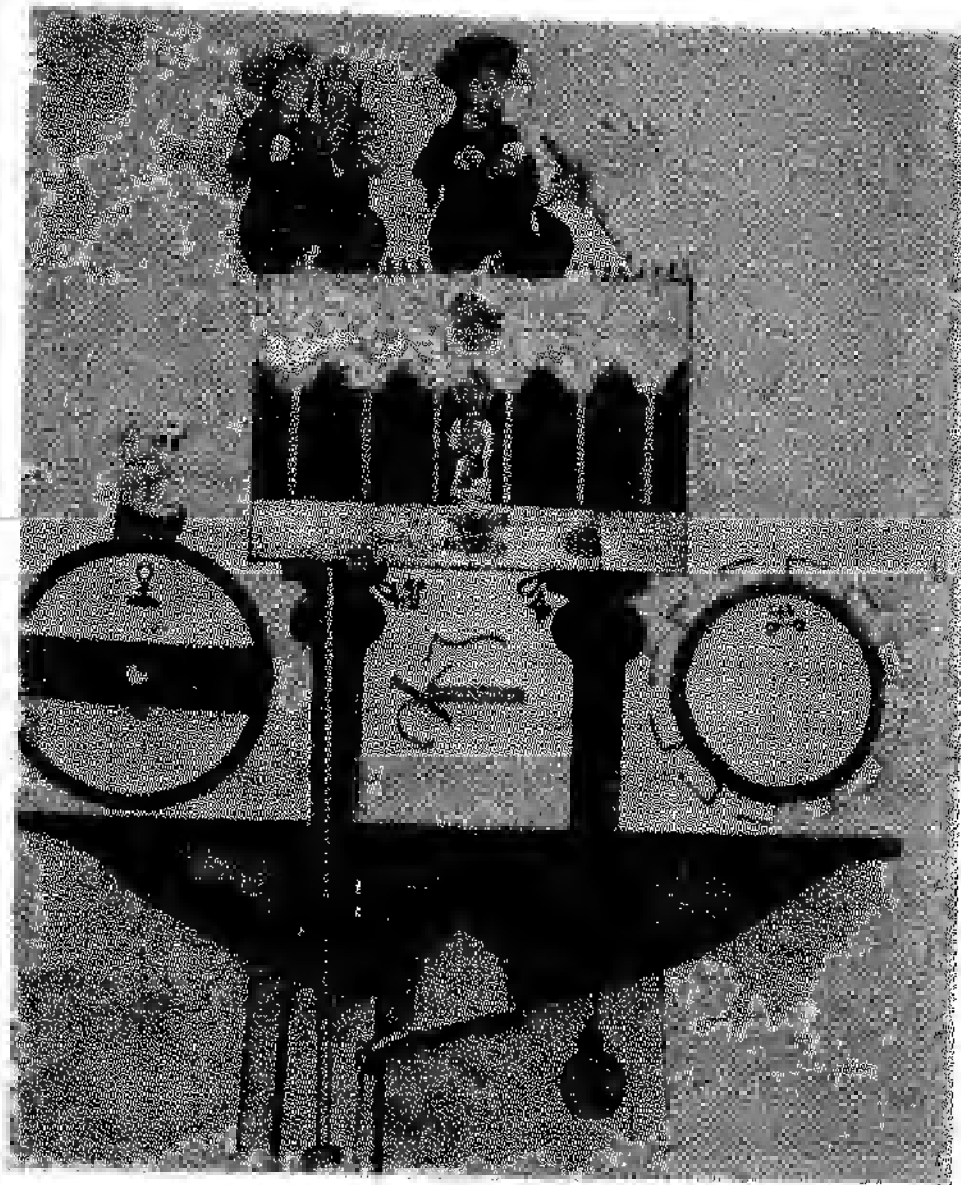


*An Anatomical study of the horse.*

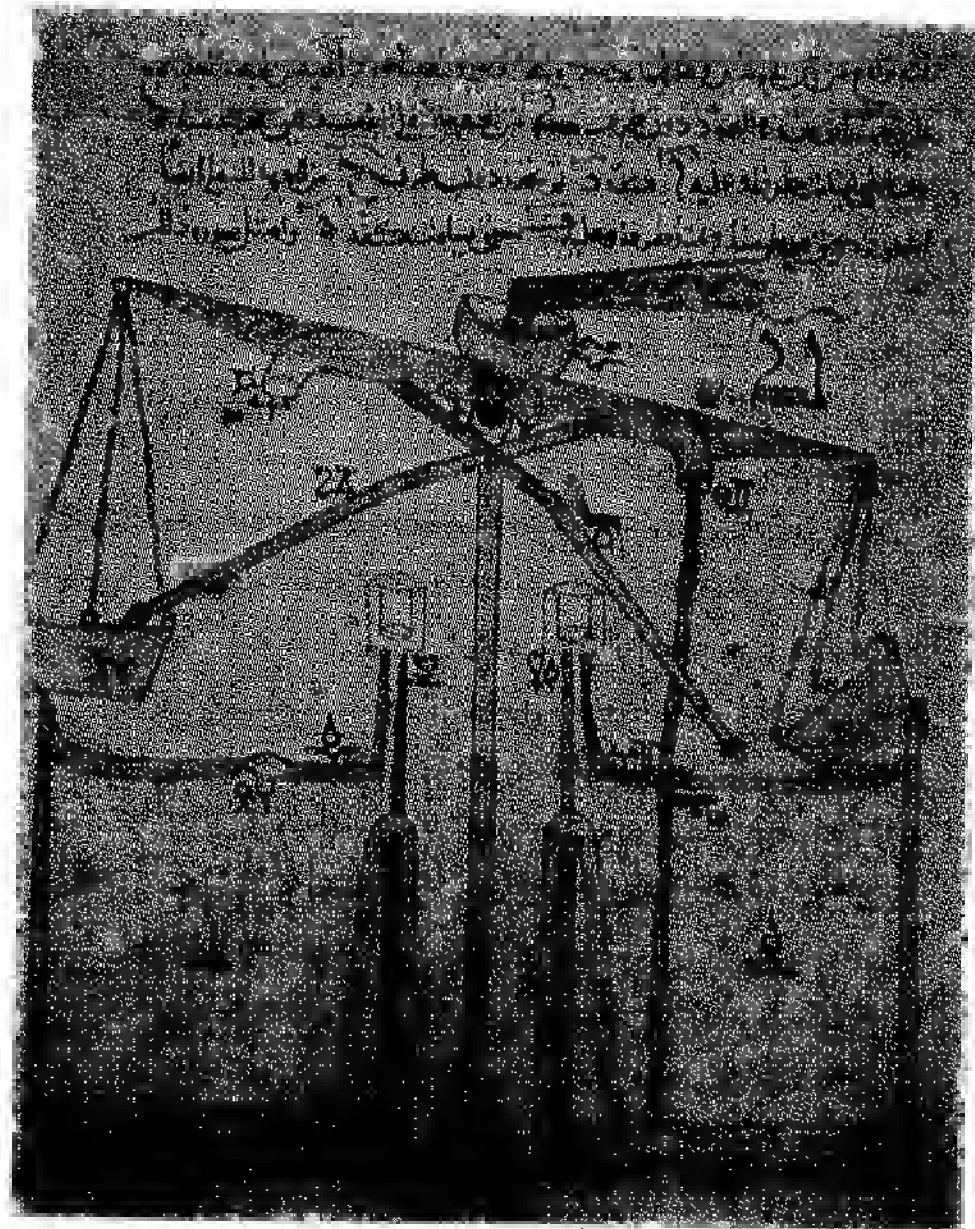




*Mechanical device  
from al-Jazari.*



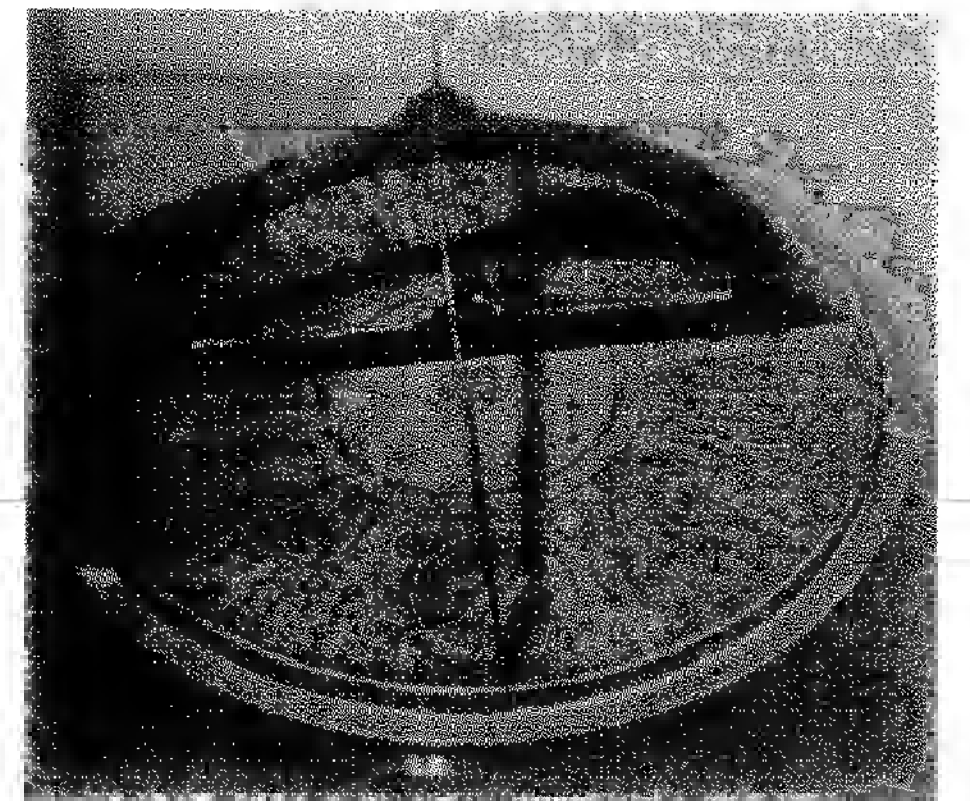
*Mechanical device on physics  
by al-Jazari.*



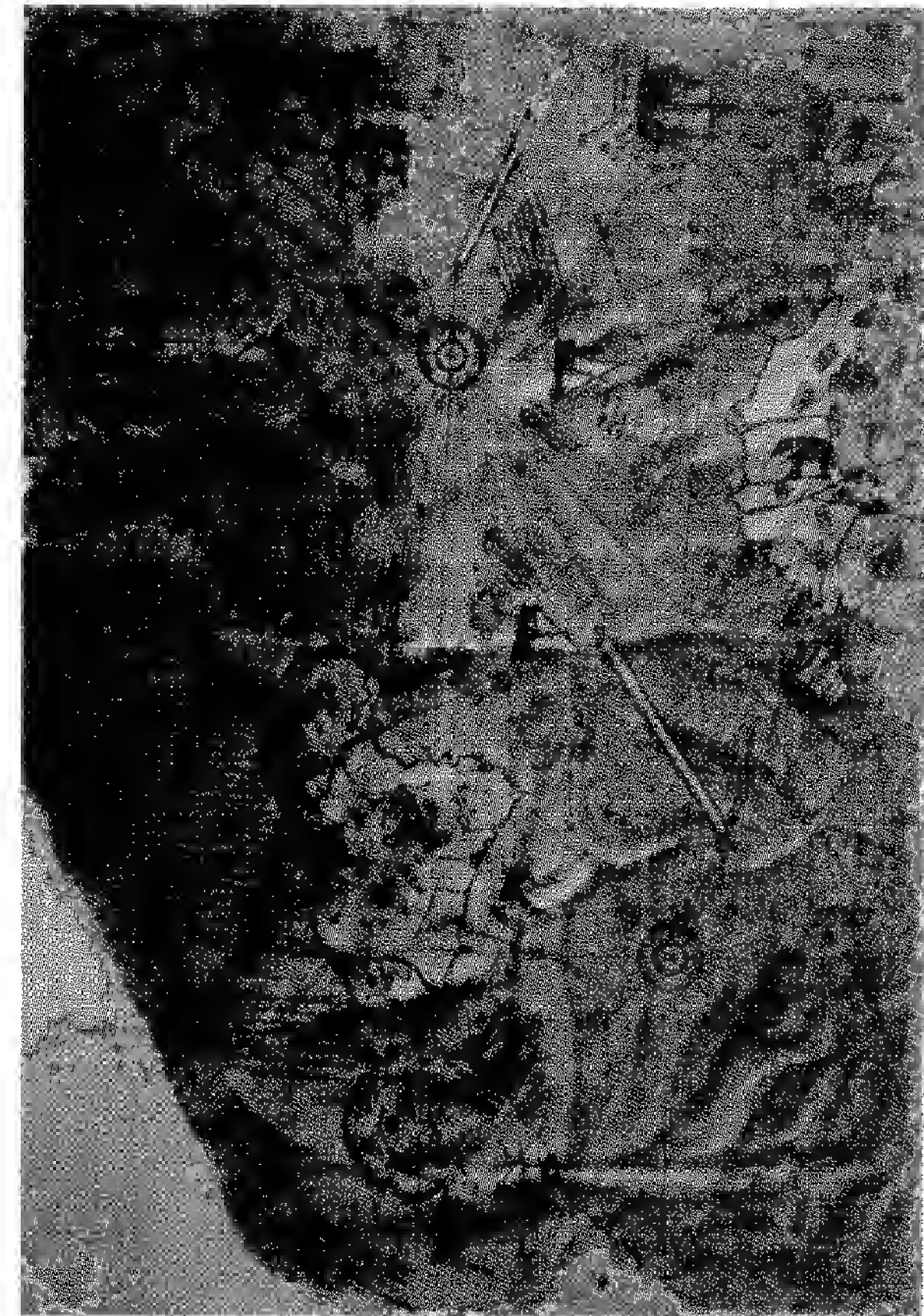
*Mechanical balance by al-Jazari.*



*The first scientific world map  
by Al-Idrisi.*

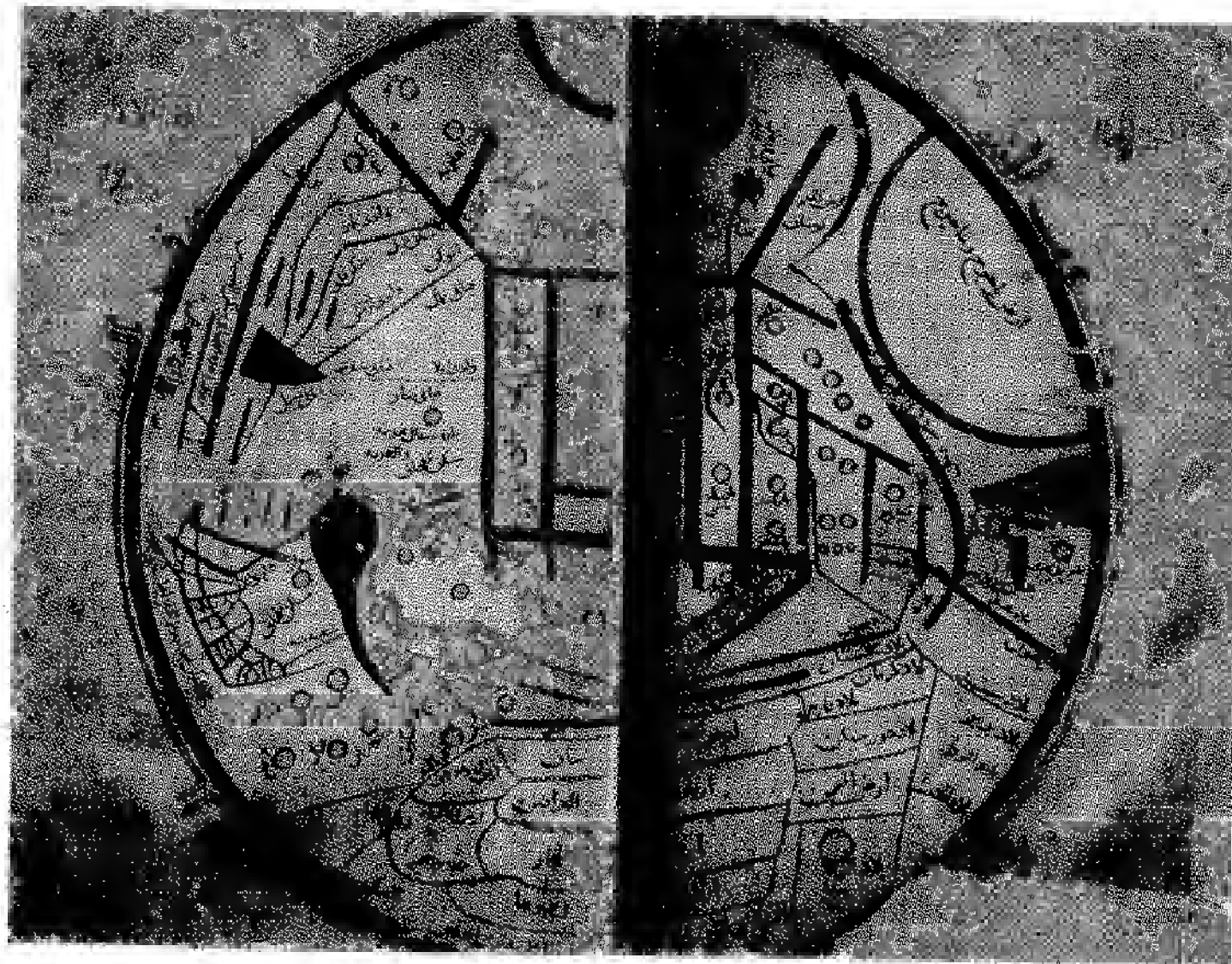


*An Ottoman compass.*



*The amazing map of America according to Piri Ra'is.*





*The Muslim lands of Western Asia according to the map of Kasgarli Mahmud.*



*A sage encouraging a man to plantation.*



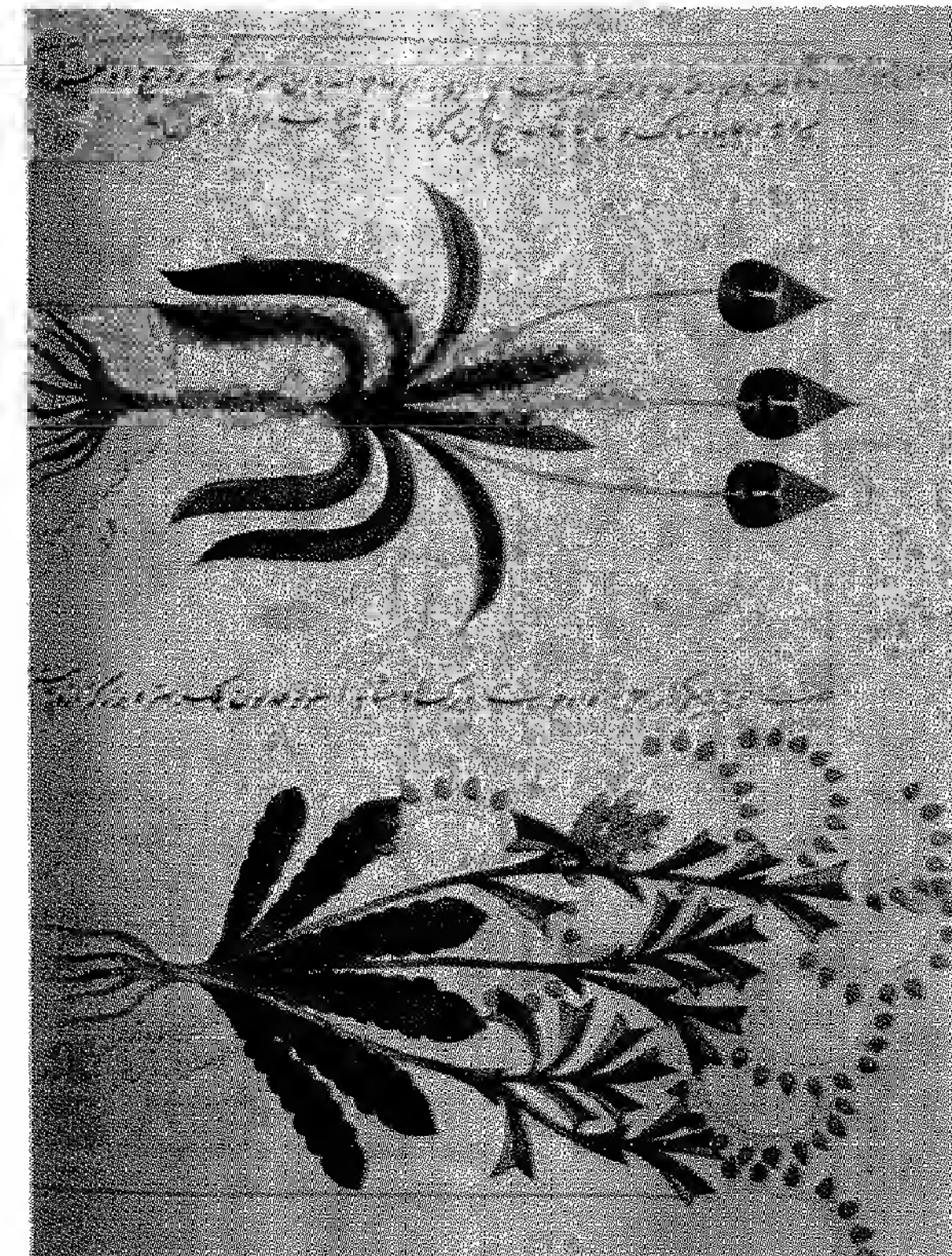
*The opening page of the treatise on simple drugs by Ibn al-Baytar.*



*An illustration of a variety of sorrel.*

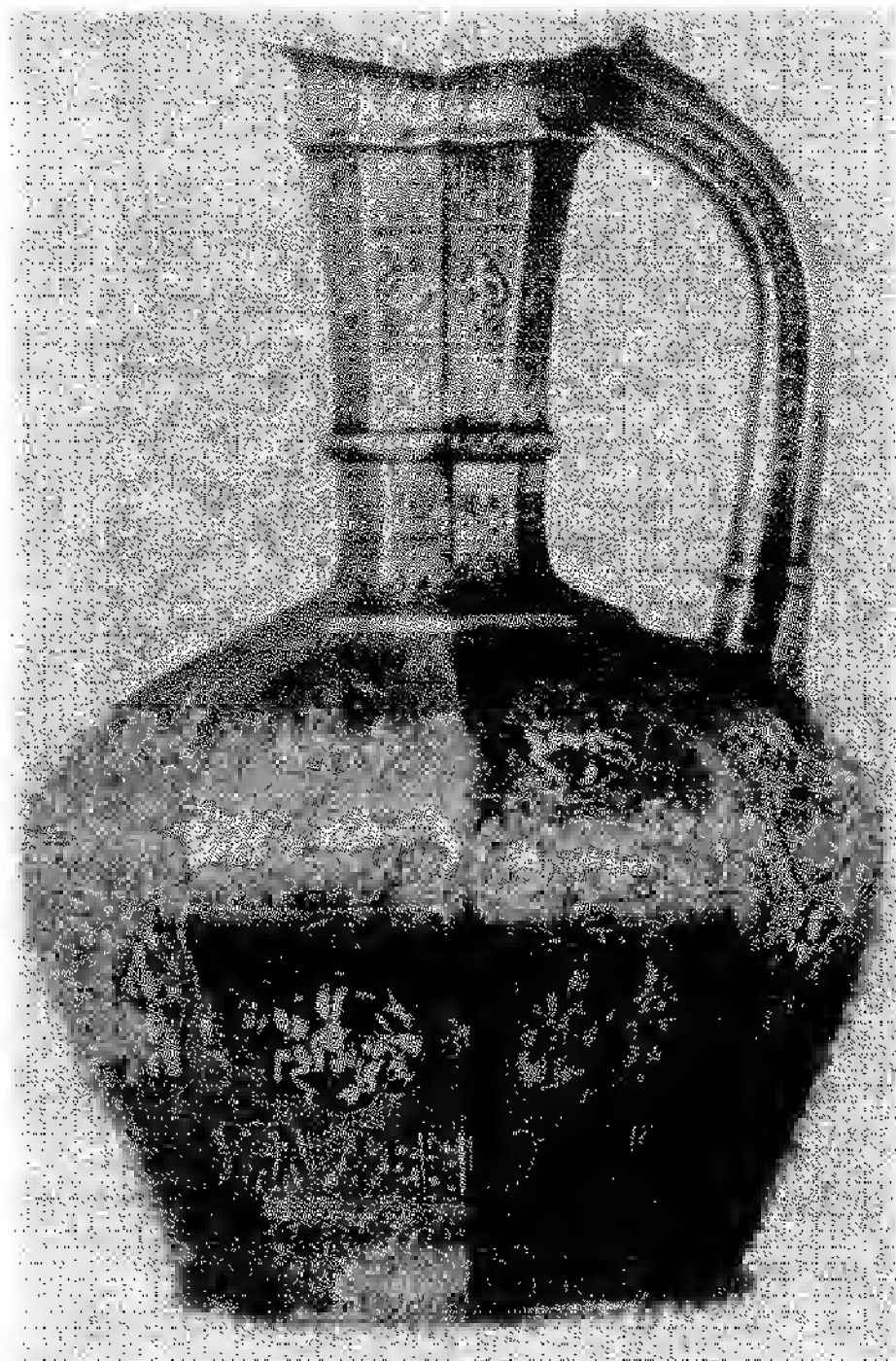


*Vine from a Persian botanical treatise.*



*An illustration of an anthropomorphous flower from a Persian botanical treatise.*





*Blacas Ewer'. Islamic metal work. It exhibits many puzzling features. It is a squat multy-faced brass object. An inscription on the neck provides the following information: "Engraved by Shuja bin Ma'nah al-Mawsili in the blessed month of Rajab year 629 (1232) in Mosul." This ewer is one of the finest products of a school of metal workers that flourished in that Iraqi City.*



*Rock Crystal Ewer. Vessel made of Rock Crystal. This object was taken by Venetian when they looted Constantinople in 1204. It was part of the Fatimid treasure.*

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## PREFACE

“Indeed! We have created man from an essence of clay, then placed him as a drop of semen in a firm resting place, then changed the semen into a leech like mass, then leech like mass into a fetus lump, then fetus lump into bones, then clothed the bones with flesh, and then We brought him forth as quite a different creature *from the embryo* – So blessed is Allah, the best of all creators.

(Surah Al-Mu'minun (23) : 12 - 14)

Decoding the glorious words that Allah ﷻ revealed to the holy prophet Muhammad ﷺ in the cave, the Muslims world brightened with sciences that contributed enormously to the colossal technology of today! ‘Read’ and ‘Pen’ are the two words that appear in the chapter *Iqra’* of the Holy Qur’an!

And it is no secret to the Muslims that these *two words* are among the first five verses revealed to Prophet Muhammad ﷺ. By Allah ﷻ, these words produced extraordinary effects on the seekers of sciences to such an extent that we can say, *there is no science which the Muslims had not excelled, ventured, learned, developed and transmitted!*

Islamic religion and Islamic sciences are inter-linked and the civilization created by Islam can hardly be overemphasized because there are so many verses from the *Qur’an* and *ahadith* that stress on sciences and the learned. Allah ﷻ says,

*“Are those who know equal with those who know not? But only men of understanding will pay heed.”*

The importance of knowledge is so stressed in Islam that many *ahadith* speak of its supremacy and power. The following are *ahadith* as well as saying of the sages, to show how knowledge is cherished in Islam:

*“The quest of knowledge is obligatory for every Muslim.”*



*“Verily the men of knowledge are the inheritors of the prophets.”*

*“Seek knowledge from the cradle to the grave.”*

*“Seek knowledge even unto China”*

Islamie science came into being from the Qur’anic revelations and the existing sciences of various civilizations. These Islamic sciences were later transmitted through its spiritual power into a new substance that was different and continues from that had existed before. Islam became heir to the intellectual heritage of all the major civilizations. It is our duty to know how Islam contributed to this modern world that we are living today. And who are the genius Muslims who were experts in these sciences?

There are many scientists today, even among the intellectual Muslims who are unaware of the treatise of the Arabs scientists. They are glamorously appraising the westerners as their GURU. These are results from a willful and thoughtful strategy framed about a century ago to boycott the spread of the Arab’s know-how, to pin merits words and to create fake honours to those who are not the very founder of certain sciences. Slowly, we are neglecting our own cultures and the sciences that our Muslim scientists strenuously achieved.

From the very outset, we have been given a book, THE QUR’AN, in which we are given the solutions to all problems. Unfortunately, we are adhering ourselves to strange cultures, and what is more; we know nothing about the contributions of the learned Muslims, the inheritors of the prophets. These learned Muslims spent sleepless nights in the search of knowledge. Besides the treasures of knowledge found in the *Qur’an* and holy traditions, we are marveled about the spectacular scientific achievement of the Muslims who by the power of Almighty Allah ﷻ, have undoubtedly made the earth a better place to live.

Definitely, books spread knowledge. But, what it would have been, if the Arabs had not transmitted to the world an important Chinese technological invention of making paper? The computer is a genius works of mathematics- *digits and binary systems*. The greatest mathematicians nowadays must be thankful to the Arab mathematicians, especially Al-Khawarizmi, whose contributions have made it possible for us to surf on the Internet.

In what fields have the Muslims not excelled? They have inscribed their names in *Geometry, Algebra, Astrology, Astronomy, Surgery, Zoology, Geography, Cosmology, Medicines, Agriculture, Pharmacology, Alchemy, Physics, Botany, Geology, Mineralogy, Architecture, Textile and many others!!*

In this book, besides unraveling the gigantic scientific strides made by the Muslims, readers will also encounter numerous archived illustrations that are self-explanatory on the astounding achievements of the Muslim scientists. Readers would realize that Muslim scientists once rained this planet with scientific discoveries and are the real causes of today’s technological advancements.

May Allah ﷻ, The Creator of all sciences, seen or unseen, accept this work and forgive the author and the readers. Ameen.

Mohammad Yasin Owadally



I dedicate this book to my daughter  
Zaynab Bibi Nabeelah Owadally



Before the rise of Islam, most of the people used Roman numbers to count, (I, II, III, IV, V etc). But this was not a good system. The Arabs introduced a new system of numbers. Perhaps the most important contribution of the Muslims in arithmetic was the introduction of this system of Indian system of reckoning. They used Arabic numerals with a point for zero (0).

[illegible]

### *The development of Arabic Numeral*

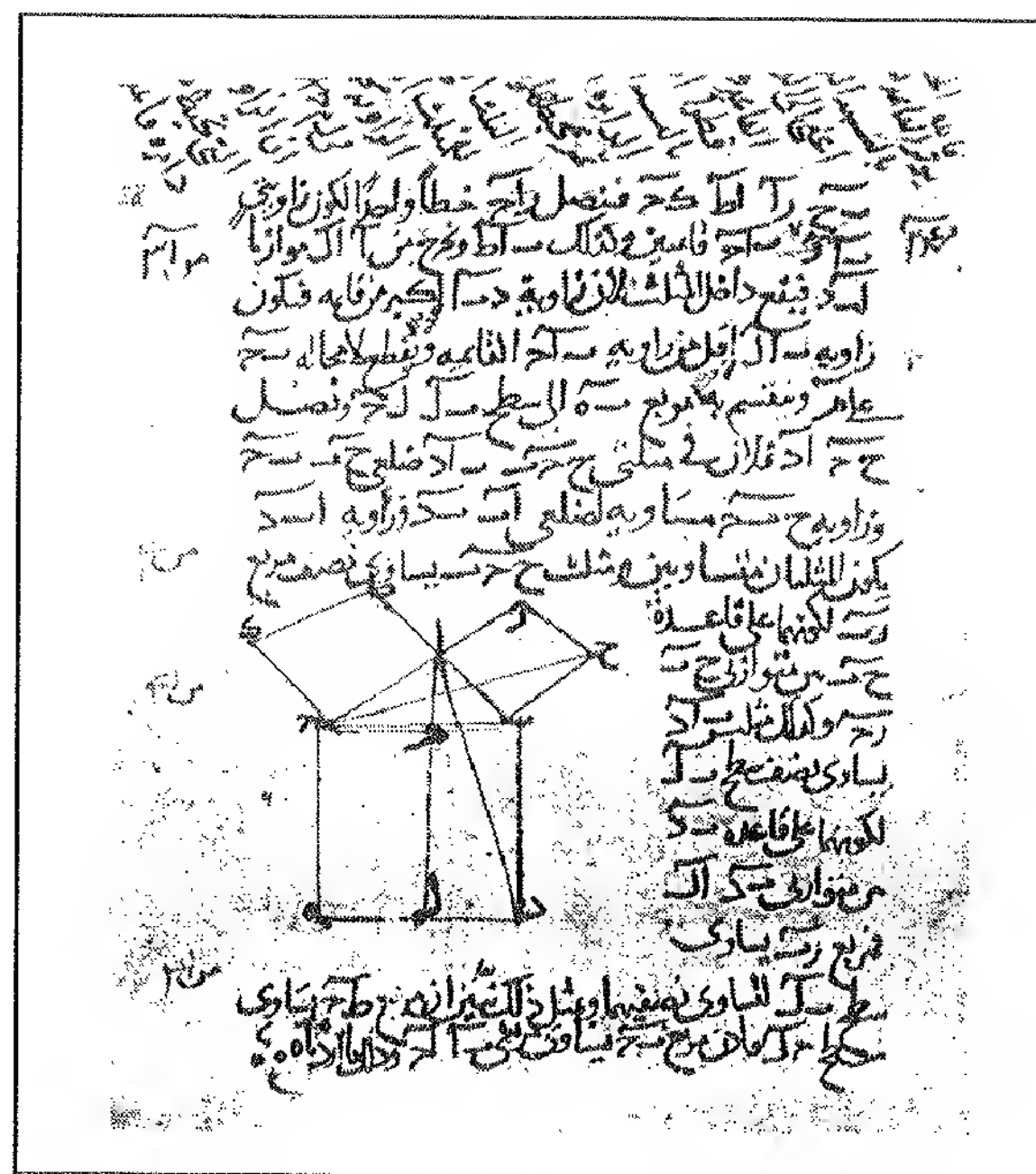
# MOHAMMED MUSA al-KHWARIZMI

Abou Dja'far Mohammed Musa al-Khwarizmi, a mathematician, astronomer, geographer was born in the year 180 Islamic Calendar or *Hijrih* (AH) / 780 Christian Era (CE) in Khwarisan.



He wrote the first book on Indian reckoning system. This book reached Europe during the 12<sup>th</sup> century and still exists in the Latin versions. These numerals became known to the western countries as, 'Arabic numerals'. His works flourished in 825 CE. This Persian who writes fluent Arabic worked for Caliph al-Mamun in Baghdad. He wrote astronomical tables, the first written work on arithmetic. It contains the calculation of square root. *Hisab al-Jabr wal Muqabalah* (The calculation of Integration and Equation) also made him very famous. He also wrote *Surat al Ard* (Images of the World) with a map of the world and heavens.

It is important to note that the name *al-Khwarizmi* has produced the word 'algorithm', which now has changed to 'Logarithm'. The word 'algebra' comes from the word 'al-jabr', which designates one of the basic operations that al-Khwarizmi used in solving quadratic equations. Al-Khwarizmi is internationally known as 'the Father of Algebra'.



At-Tusi Geometrical treatise

## ABUL HASAN al-UQLIDISI

Abul Hasan al-Uqlidisi was a Damascene arithmetician of the 10<sup>th</sup> century.

After al-Khawarizmi, innovation works on arithmetic were introduced by Abul Hasan al-Uqlidisi. His famous book, *Kitab al-fusul fi'l Hisab al-Hindi* (Book of the parts of Indian arithmetic) was composed in 341 AH in Damascus. This book dealt with the explanation and application of the decimal fractions. Only recently, after five centuries, this innovation was attributed to another arithmetician, al-Kashi.

## UMAR KHAYYAM

Umar Khayyam, born as Abou Al-Fath Omar ibn Ibrahim Al-Khayyam in the year 443 AH / 1045 CE in Persia. He is great mathematician and a poet. In the west, he was better known for his poems. He died in the year 527 AH / 1130 CE in Nishapur.

Umar Khayyam divided his works on equations into 25 categories, and then attempted to solve them giving numerical solutions for equations of first, second degree, that is those containing  $x^3$ . The Arabian word, *Hisab*, which refers to the art of reckoning and, generally, to the process of determining unknown from the known quantities, was used to cover fundamental operations (addition, subtraction, multiplication and division), root extraction and algebraic procedures.

A new chapter was created in the study of geometry when Umar Khayyam and later by Tusi, re-examined the fifth postulate of Euclid pertaining to the parallel line theorem, which is the very foundation of Euclidean geometry. Umar Khayyam in his treatise *Fi Sharh Ma Ashkala Min Musadarat Kitab Uqlidus* (Concerning the difficulties of Euclid's elements) considers the quadrilateral ABCD with sides B and BC equal to each other and both perpendicular to BC, which is the BI-rectangular

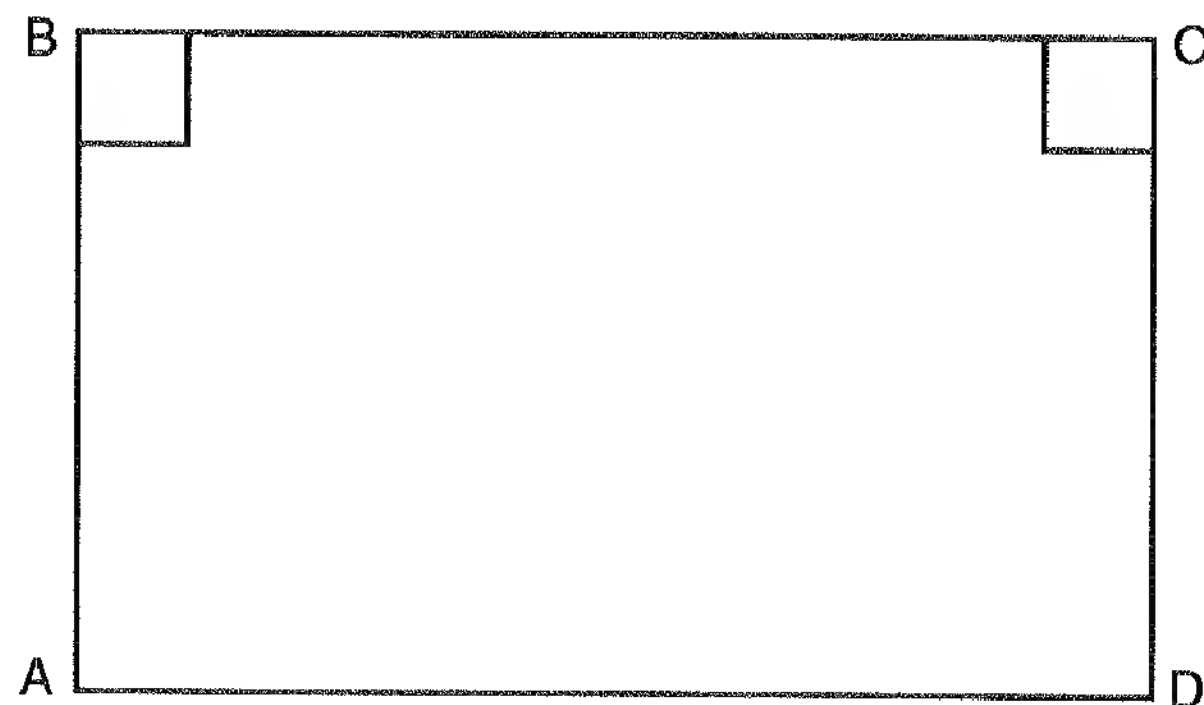


quadrilateral. Later in the western history, these findings were associated with *Saccheri*.

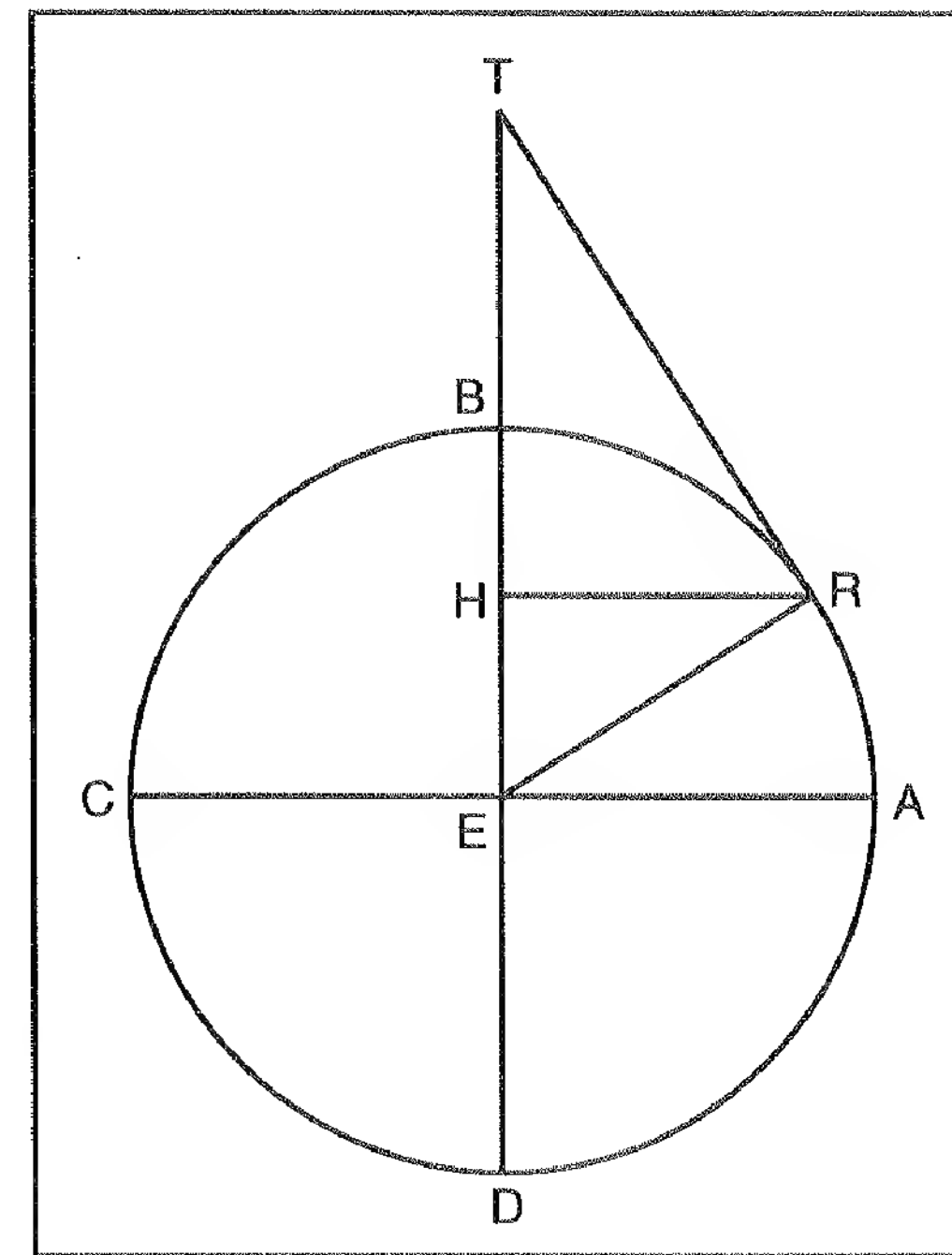
[Euclid is a Greek mathematician who lived in Alexandria during the year 260 BC. He wrote the “Stoicheia / Elements” in 13 books. Nine of which deals with the plane and solid geometry whereas the other four deals with number theory. His greatest achievement is in the systematic arrangements of previous discoveries based on *axioms, definitions and theorems*.]

In this quadrilateral, angles A and D are equal and must be acute, obtuse or right angles (see illustration below). Umar Khayyam proves that only the third can be true, thus asserting the fifth postulate of Euclid. Both Umar Khayyam and Tusi realised that if the first possibility were to be true, the sum of the angles of a triangle would be less than  $180^\circ$ . Umar Khayyam also realised the special character of the fifth postulate and pointed to the principle, which defines this geometry as a coherent and distinct system, corresponding because of its symbolic nature to the profoundest aspects of physical reality.

On geometrical problems and solutions, we also have works of others like Al-Kharaji whose works flourished during the year 1000 CE, As-Samawal (died 1175 CE) and Ibn Haytham (died 1040 CE).



*Rectangle related to the 5<sup>th</sup> postulate of Euclid*



*Algebraic problem by Khayyam. The problem is to find the point R on the quadrant AB in such a way that  $AE: RH = EH: HB$*

## IBN HAYTHEM

Ibn Haythem was born as Abou Ali Ibn Al-Hassan Ibn Al-Haythem in Iraq in the year 354 AH / 965 CE and died in 1040 CE in Cairo. He wrote more than 150 books. Among them, 19 works are on mathematics. One of his important optical works was translated in Latin in 1572.

Muslim scholars also made advances in geometry (mathematics dealing with lines, angles surfaces, solids, space etc) and Trigonometry (mathematics that deals with the sides and angles of a triangle).

Islamic geometry was founded on a deep study of the Greek works and was also influenced by the Indian *Siddhanta* (final



conclusion). Of particular interest is the use of conic sections to solve problems and make calculations. Geometry was applied successfully in the fields of surveying and in the construction of machines, including siege engines.

## AL-BATTANI

There is no doubt that the Muslims were the inventors of plane and spherical trigonometry. In spherical trigonometry, a Muslim scholar, Al-Battani presented an important formula involving 3 sides and angle of a spherical triangle. His real name was Abd'allah Mohammad Ibn Jabir al-Battani. Born in Harran (New Turkey) in 850 CE and died in 929 CE.

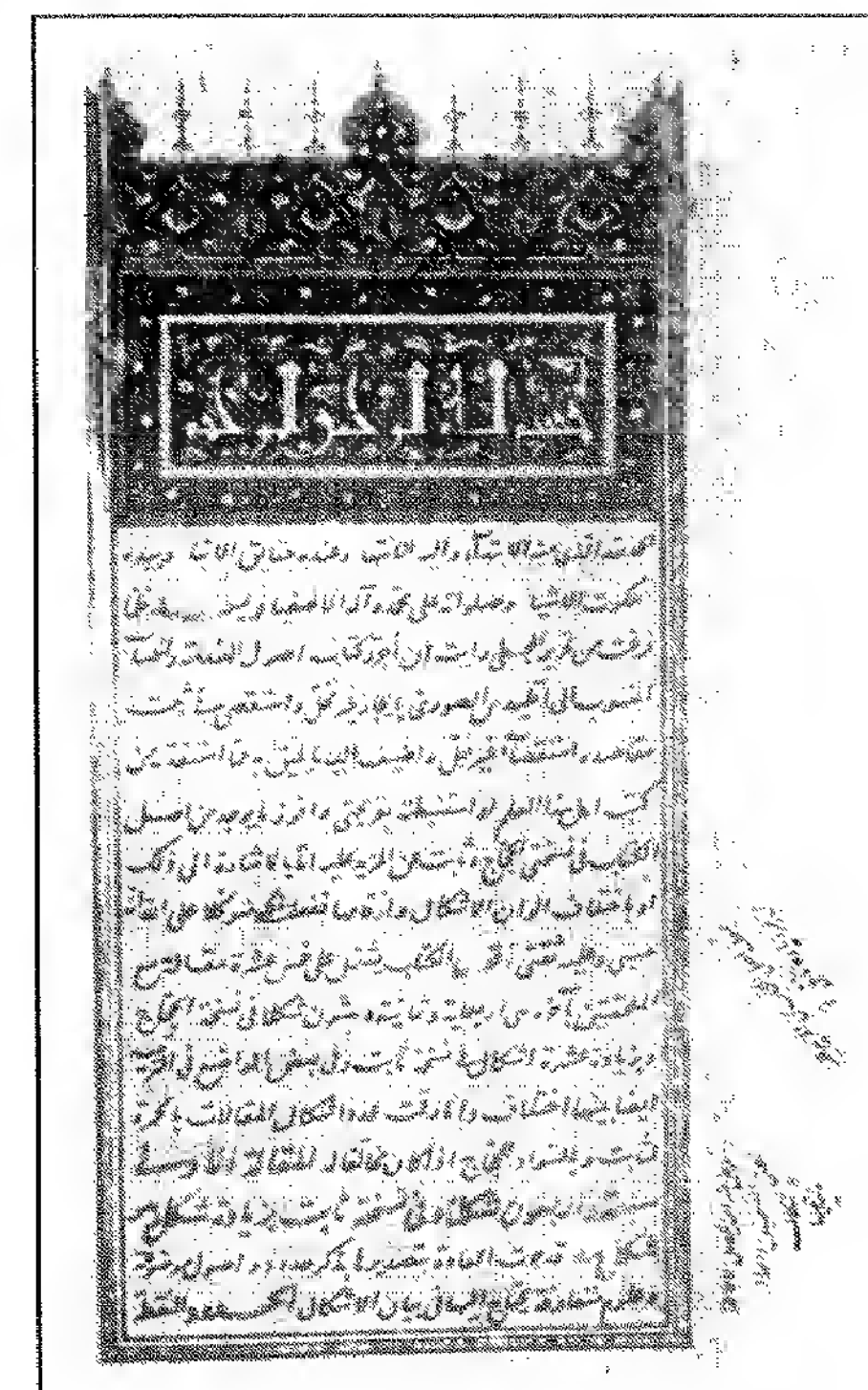
## ABUL Wafa

Another great Muslim mathematician who made further advances and success in geometry and trigonometry is Abul Wafa Mohd. Al-Bauzjani (940 – 998 CE). He was also an astronomer.

Probably, he was the first to demonstrate the sine theorem for the federal spherical triangle and proposed a new technique for the construction of sine tables. He also invented the trigonometry quantities, secant and cosecant.

## SIBT al-MARIDINI

Originally, Muslims used finger computation (*Hisab al-Yad*). In the early 8<sup>th</sup> century, Muslims learned the Indian numerals and the 'dust-board' system (*Hisab al-Ghubari*) from the Indian and Persian sources. Even after learning these new methods, finger computation continued. Moreover, Muslims inherited the sexigesimal system (fractions; those having base sixty) from ancient Babylonia. This system was used especially by the astronomers even after the decimal system had been adopted.



*The opening page to the commentary on the elements of Euclid by Nasir al-Din al-Tusi*

Using letters to symbolise numbers (*Hisab al-Jummal*) and sexigesimal system spread widely throughout the Islamic world over the centuries. In fact, the sexigesimal system became to be known as "arithmetic of astronomers" (*Hisab al-Munajjimin*).

In the late 14<sup>th</sup> century, Sibte al-Maridini, another great Muslim mathematician, wrote a book on this system called *Raqa'iq al-Haqa'iq Fi Ma'rifat al-Daraj wa'l-daqa'iq* (Delicacies of the Truth concerning Knowledge of Degree and Minute).

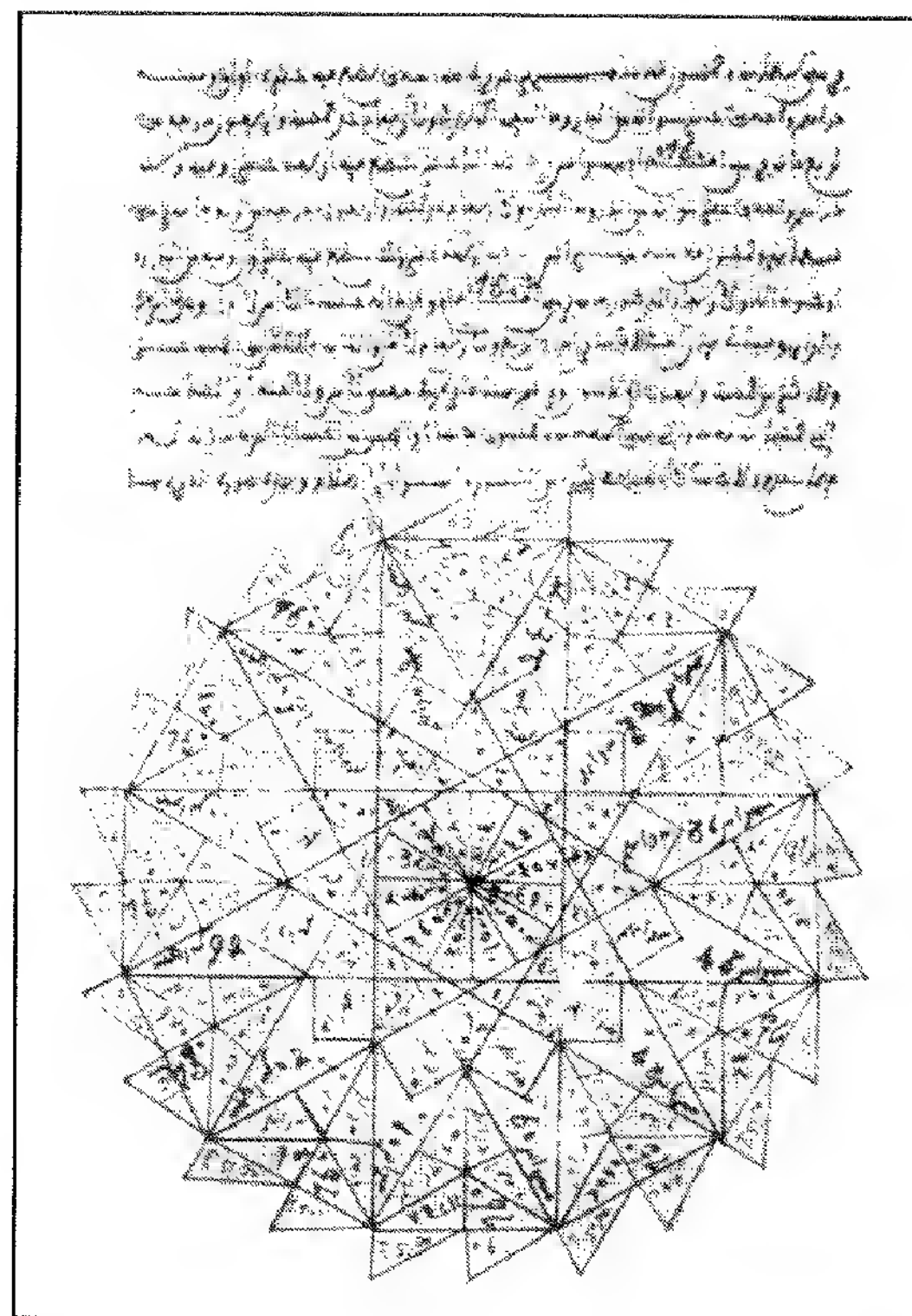
On the development of decimal system, the Muslims fused various methods of reckoning into a system, which was based on the Indian numerals and place-system.

It is no secret! Presently the computer is the greatest scientific invention. Through computer, one can control the world

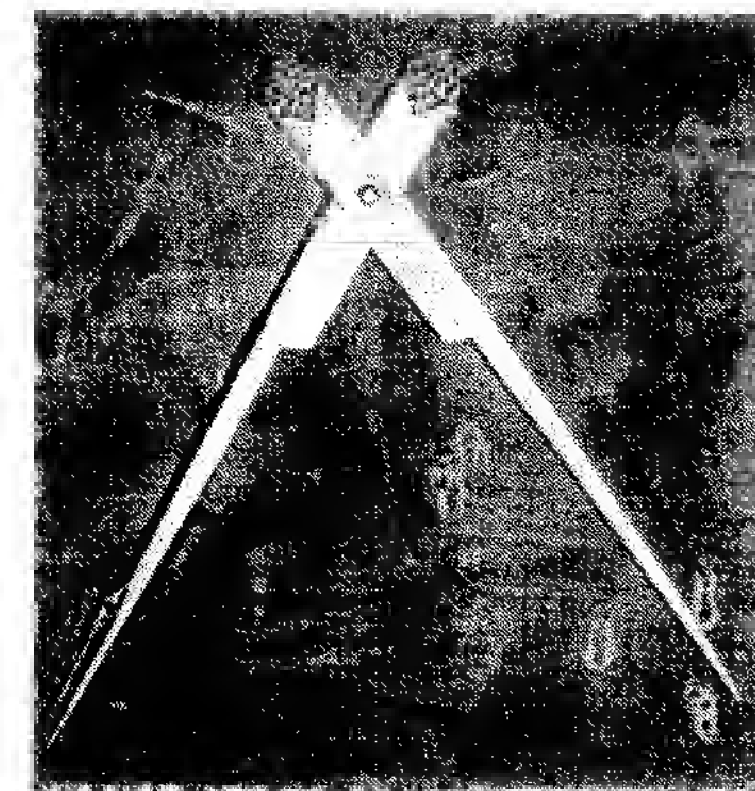


media, surfing on Internet, wage technological wars just by touching a switch. But, this greatest invention and wonders of the computers are made possible only by the mathematicians.

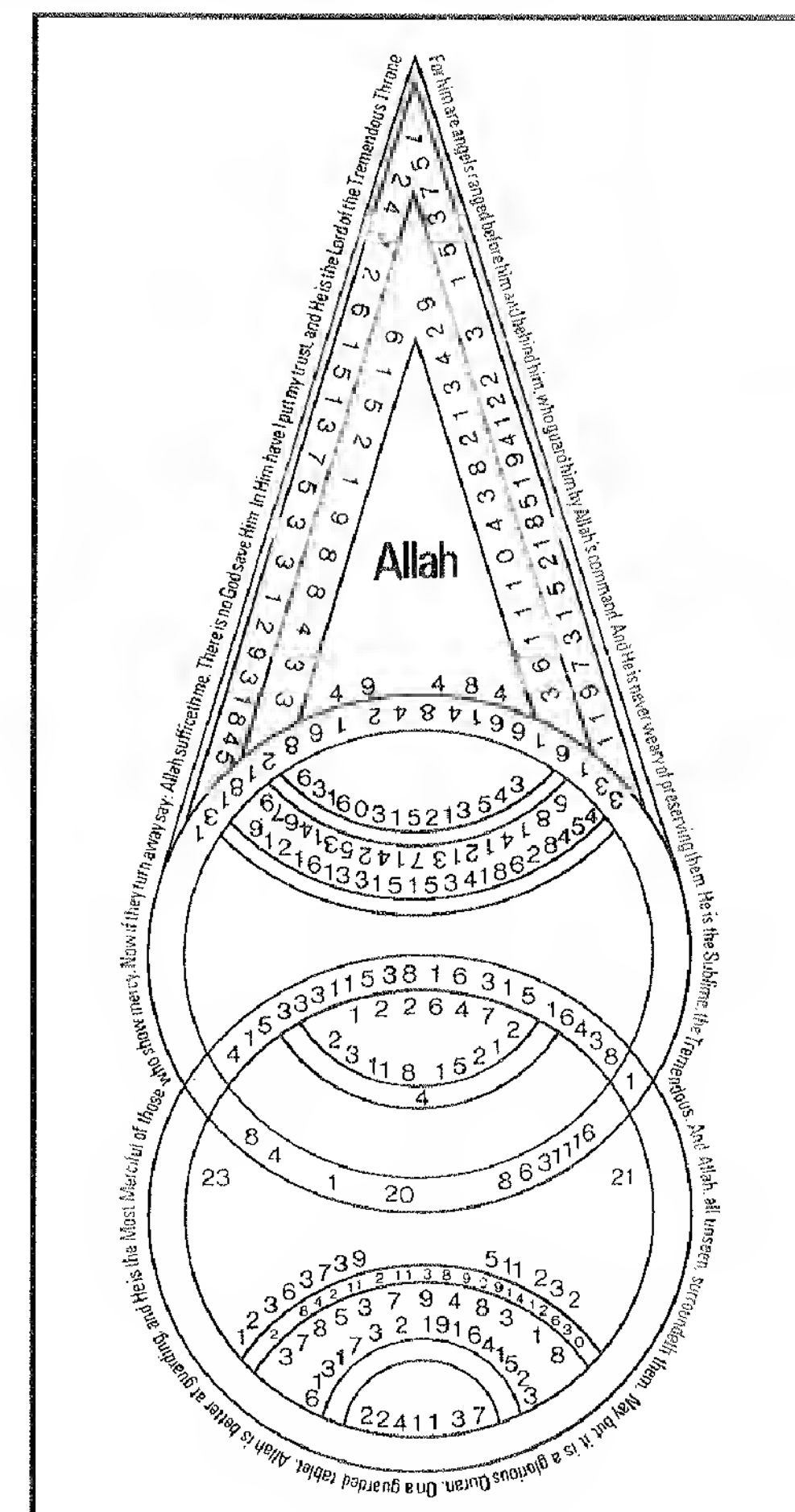
The computer is programmed by digits, which are genius works of mathematicians. Therefore, credit should go to the Muslims who founded and invented mathematics by the power of Allah the Almighty. It is a fact that in Islamic art and architecture, mathematics plays a very important role. The Muslims not only applied mathematical principles in music and poetry but also to other traditional arts e.g. the plastic arts, geometrical patterns and patterns on carpets, patterns on ornaments of mosques and glass wares etc.



*Geometric and numerical patterns used as the basis for the construction of various devices and instruments.*



*Steel compass made for the Persian king Shah Abbas.*

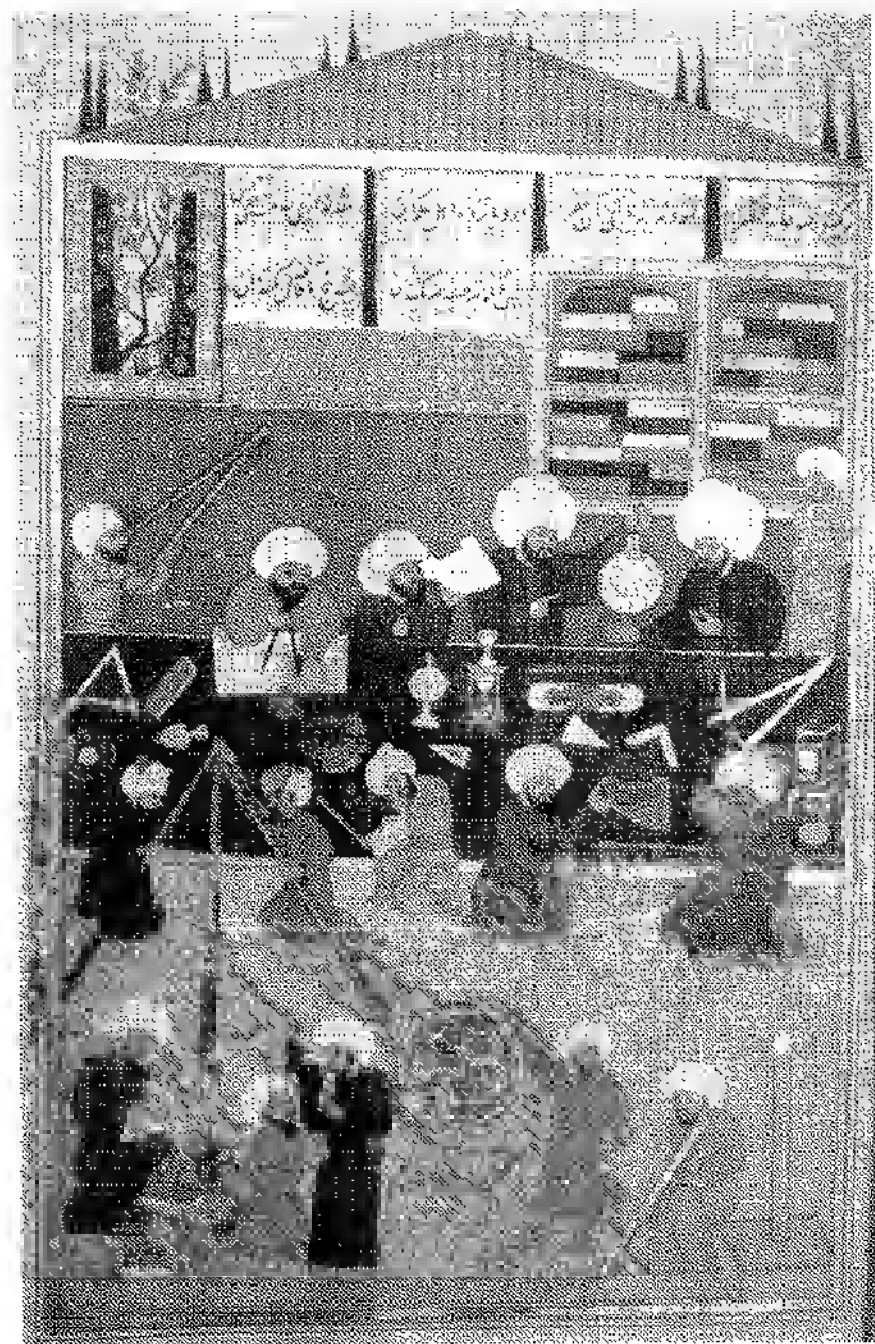


*Cosmological schemes relating Qur'anic verses to the symbolism of numbers according to al-Din al-Buni.*



# ASTRONOMY

Works on astronomy and the related subjects are found in abundance in Muslim language such Arabic, Persian, Turkish, Urdu and others. Many of these works have remained scattered in the form of manuscripts in great libraries and are unpublished. Despite two centuries of study by western scholars only a small part of these materials have been analysed. These vast materials are works of several different types.



*Taqi al-Din and other astronomers working in Istanbul.*

Some are treatise devoted to a single facet of the science, such as the fixed stars, a particular instrument. Some are descriptive accounts of astronomy without mathematical treatment. The first impulse for the study of mathematical astronomy in Islam came from the translation of an Indian treatise, *The Siddharta*, in Baghdad in 155 AH (771 CE). During the period other Indian works became available. An Arabic translation was made from *Pahlavi* work in early 3rd century AH and translated the astronomical tables of the kings.

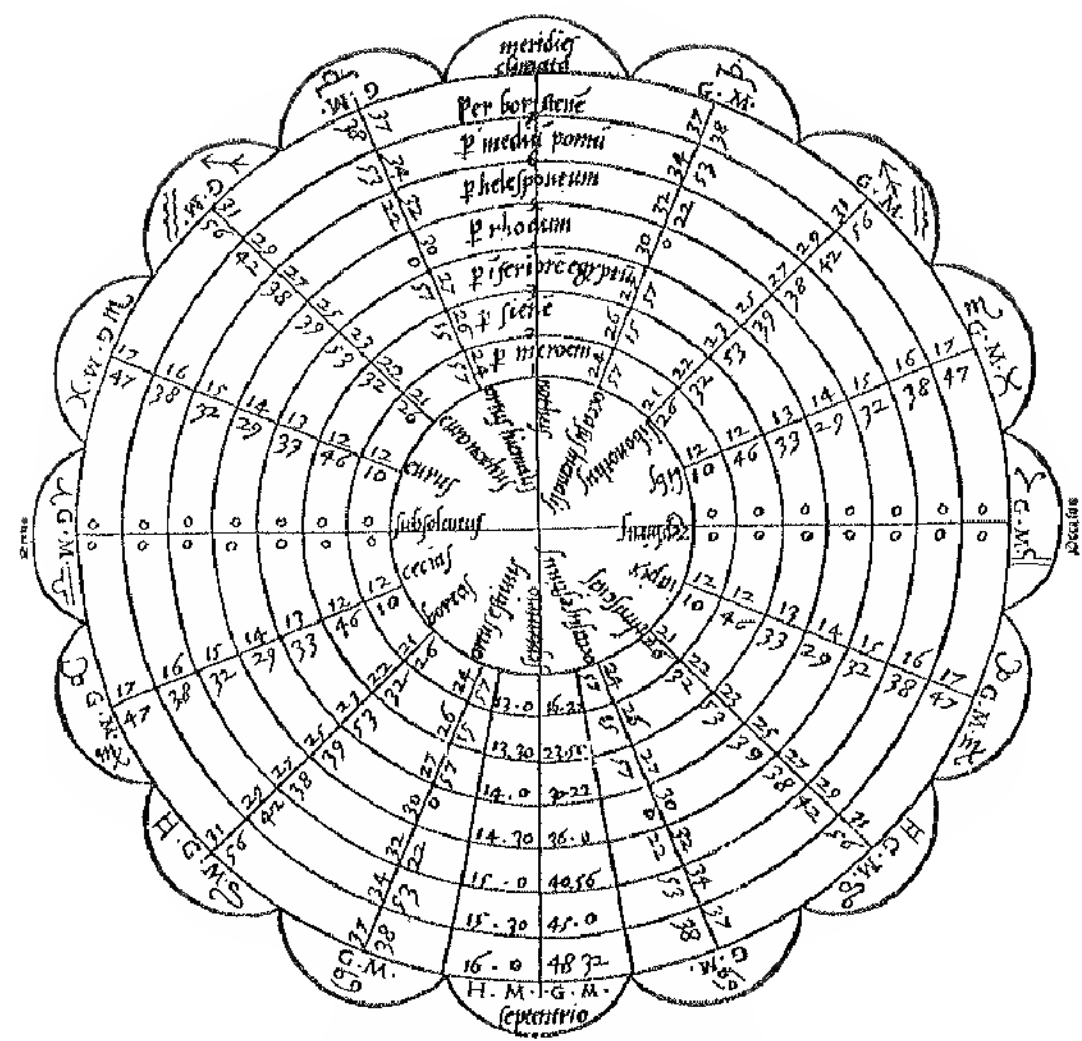
*Pahlavi* was a language of Indo-Iranian subfamily of Indo-European family language. It was also called the *Middle Persia* language.

## IBN al-SHATIR

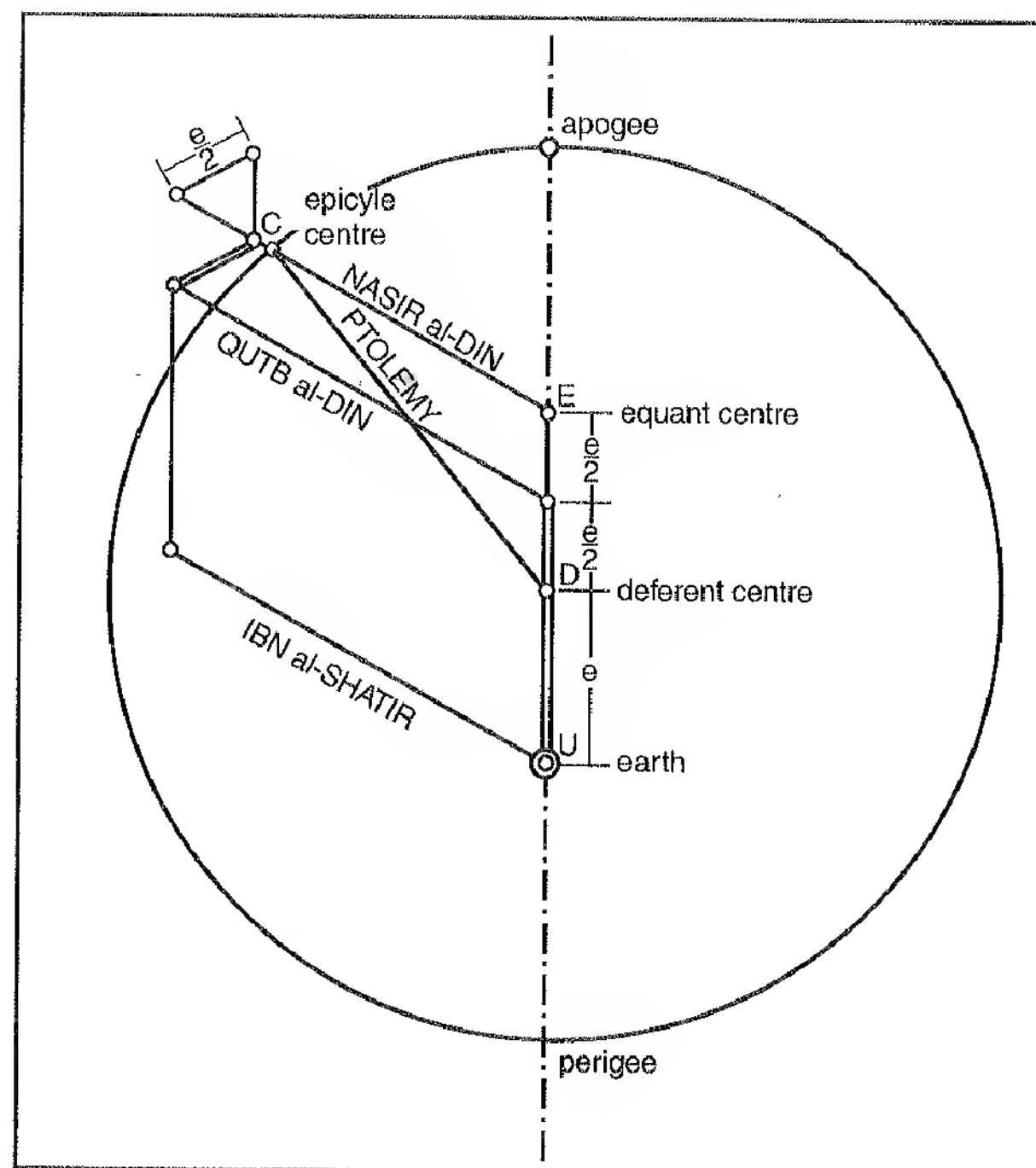
During the 3<sup>rd</sup> century, the Arabs started translating the Greek works of the school of Alexandria. In those days, *Almagest* was of great influence in the middle ages, both in Islamic world and the west. *Almagest* is derived from the Arabic article "Al" meaning "the" and the Greek word "Majisti" meaning "greatest". This book was compiled by a Greek astronomer and geographer, Ptolemy. He developed the earth-centered or geocentric theory whereby the earth is the center of the universe with sun, moon, and stars revolving around it. However, his explanations on the planetary motion were extremely difficult. Therefore, Ptolemy was forced to introduce geometrical constructions involving eccentric circles and epicycles to explain his theory. Even with this, Ptolemy was unsuccessful.

Ibn al-Shatir, a mathematician and astronomer of the 8<sup>th</sup> century, finally solved the intricate problems faced by Ptolemy. It should be noted that until the 16<sup>th</sup> century, Ptolemy's geography was a standard source of information.

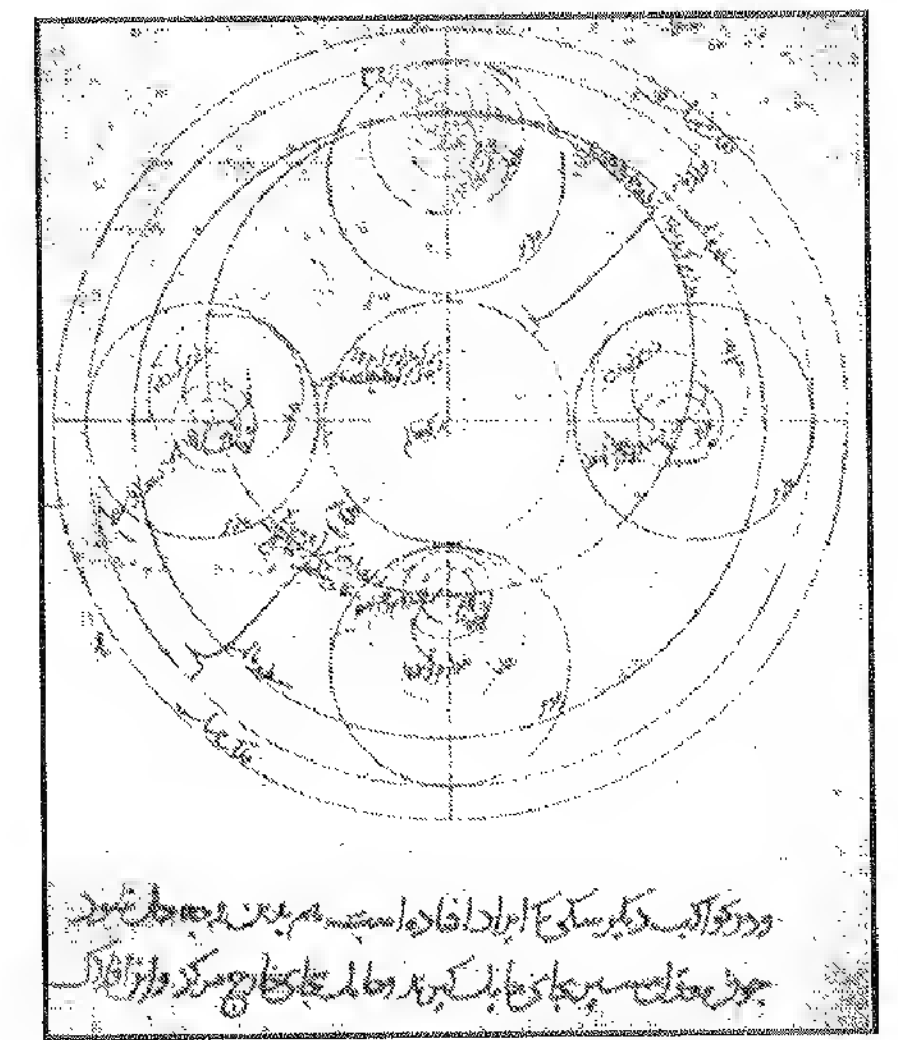
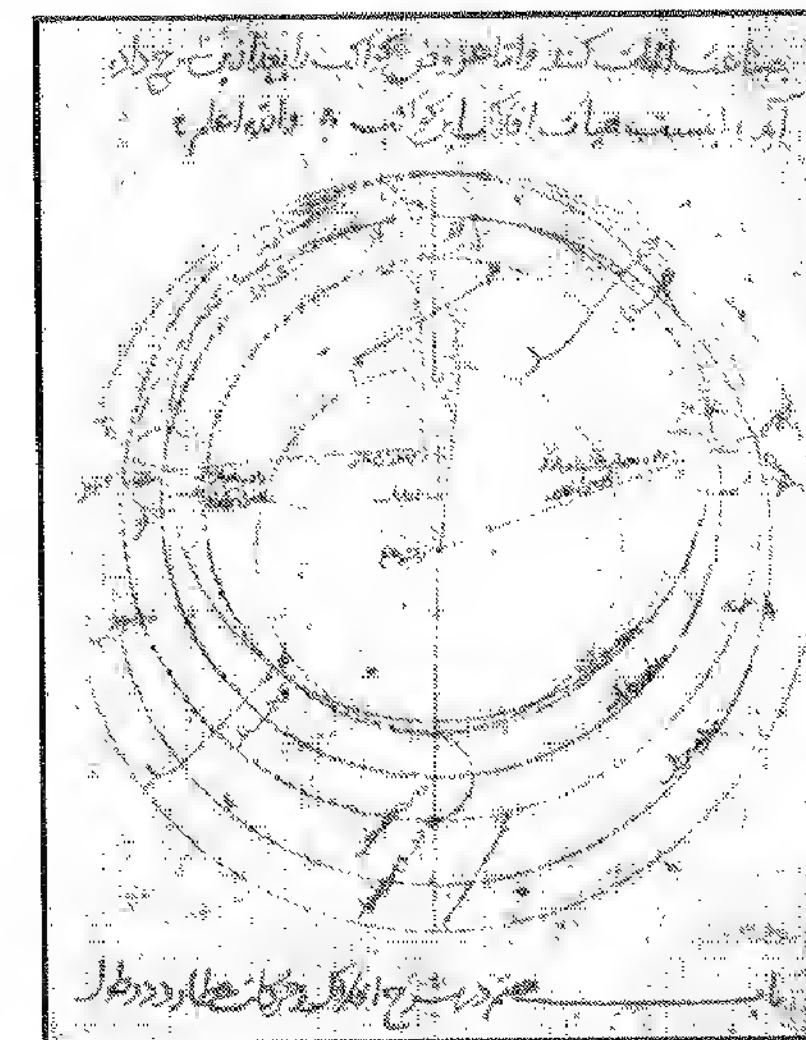
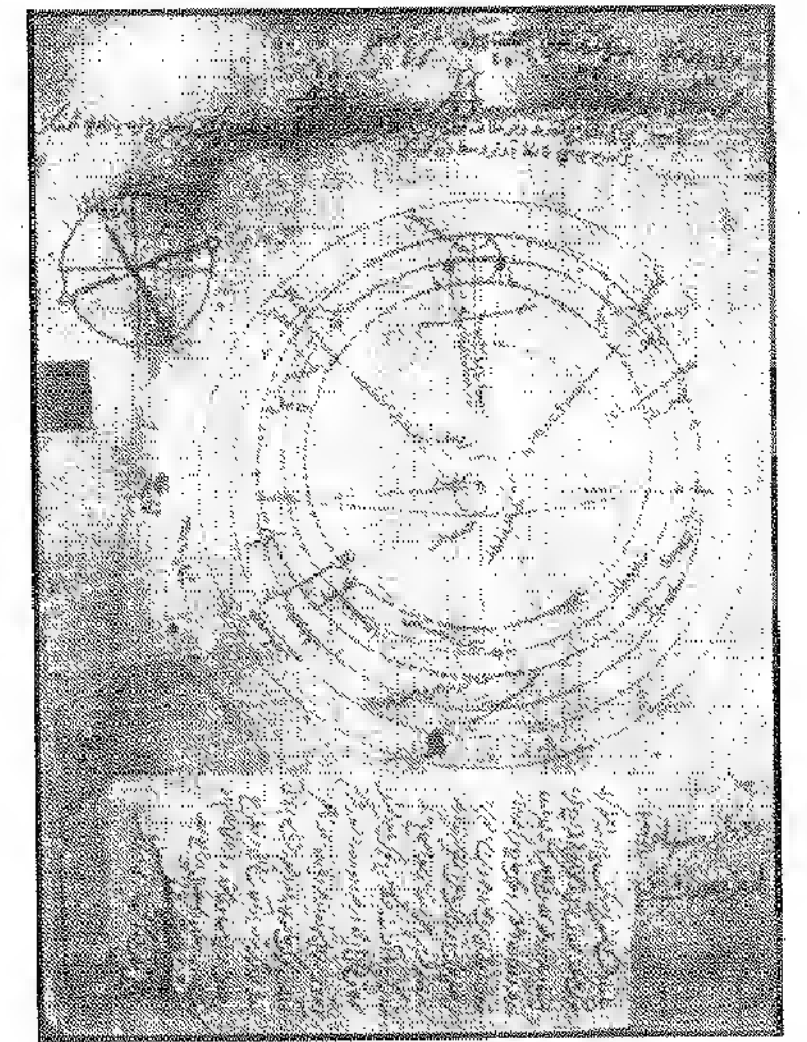
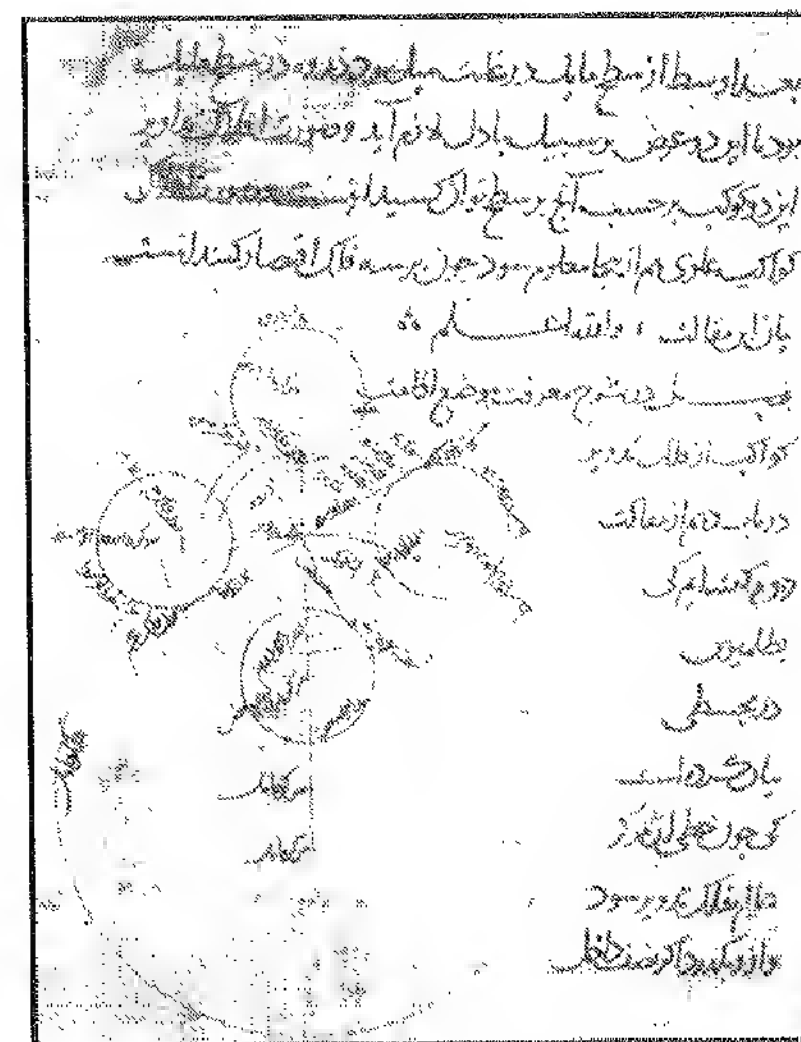




*A Latin translation of a zodiacal diagram made by Thabit bin Qurrah.*



*The later development of planetary theory by Nasir al-Din and Ibn al-Shatir.*



*Various models for planetary motion by Nasir al-Din al-Tusi.*

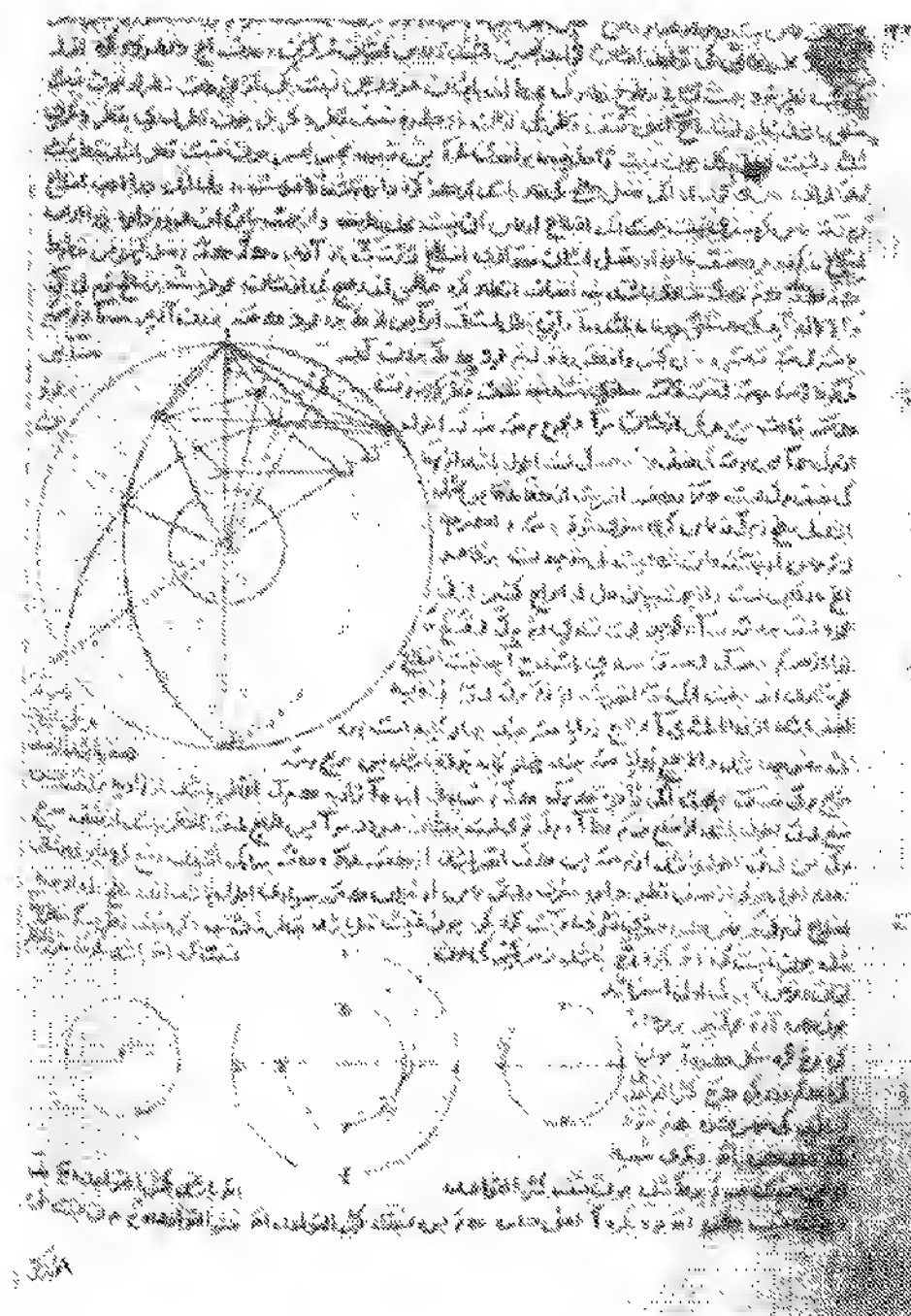
## AL-KHALILI

The main astronomical achievement of the Muslims to the fields of observation, instrumentation and in the development of spherical trigonometry for the solutions of problems is



astronomical mathematics. The Muslims were able to correct many Hellenistic numerical values for astronomical quantities, including the obliquity of the ecliptic. The obliquity of the ecliptic is the angle between the sun's apparent path, the ecliptic, and the celestial equator, the other great reference circle in the sky.

These new values proved equally valid when the heliocentric or sun-centered system replaced the geocentric view of the universe. Muslims astronomers also applied astronomical mathematics to a number of practical problems such as timekeeping, *Qibla* (direction of Mecca from a given locality). From the third to the eight centuries AH the solution to the *Qibla* problems became increasingly more accurate as trigonometrical and computational techniques improved. These efforts reaped its fruit when Al-Khalili, a Syrian astronomer, accurately produced the *Qibla* tables.



A page from the astronomical section of the Persian encyclopaedia *Durrat-al-taj* of Qutb al-Din al-Shirazi.

## ABU REHAN AL-BIRUNI

Abu Rehan Mohammad Bin Ahmed Al-Biruni was born in 973 CE in a village near Khawarzam, a famous city in Iran. He was a famous scholar and astronomer. He gained mastery in Arabic and its literature because he was highly impressed in the ocean of knowledge that was found in Arabic literature. He also made great progress in many sciences namely mathematics, astronomy and geography. His teacher and guide was Mansur Bin Ali.

After 23 years in Khawarzam, Al-Biruni moved to Tabristan where he wrote "*Al-Athar al-Baqia*" meaning "The Chronology of Ancient Nations" and dedicated the book to Sultan Qabus. In the book, he quoted 114 books, which dealt with the sciences of geometry, astronomy, mathematics, geography, geology and medicine.

Al-Biruni then visited India during the early years of the 11<sup>th</sup> century and spent many years in this sub-continent. During the years in India, he learnt *Sanskrit* and wrote his memorable book, "*Kitabul Hind*" in Ghazna, formerly Ghaznarid Afghanistan, now Ghazi Afghanistan. In this book, he describes the geography and the history of India. During his stay in India, local scholars learnt from him and they were so impressed by his vast knowledge gifted by Allah. They gave Al-Biruni the title "*Ocean of Knowledge*".

After the death of Sultan Mahmud, his son, Mu'ad, came to the throne in Ghazna. Al-Biruni was honoured with the same respect by Sultan Mu'ad. During this period, he wrote another book called "*Al-Qaman al-Masu'di*". This book was on the science of astronomy.

Besides Arabic, Al-Biruni was also conversant with Turkish, Persian, Sanskrit, Hebrew and Syrian. He has written more than 125 books. He dedicated his "*Tarikh al-Hind*" (A History of India) and "*Kitab as-Saydalah*" (A treatise on drugs used in medicine) to Sultan Mu'ad.



On astronomy, Al-Biruni discussed with approval the theory of the earth rotation on its axis and made accurate calculations of the latitude and longitude.

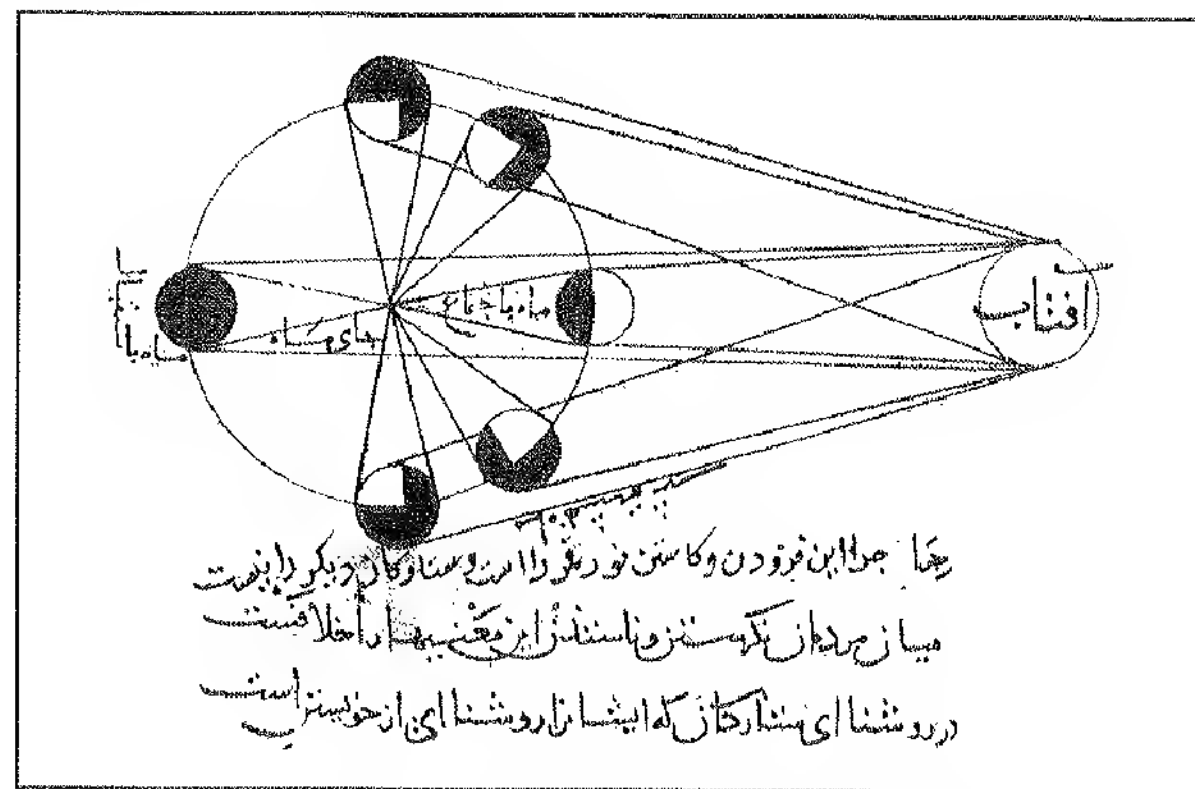


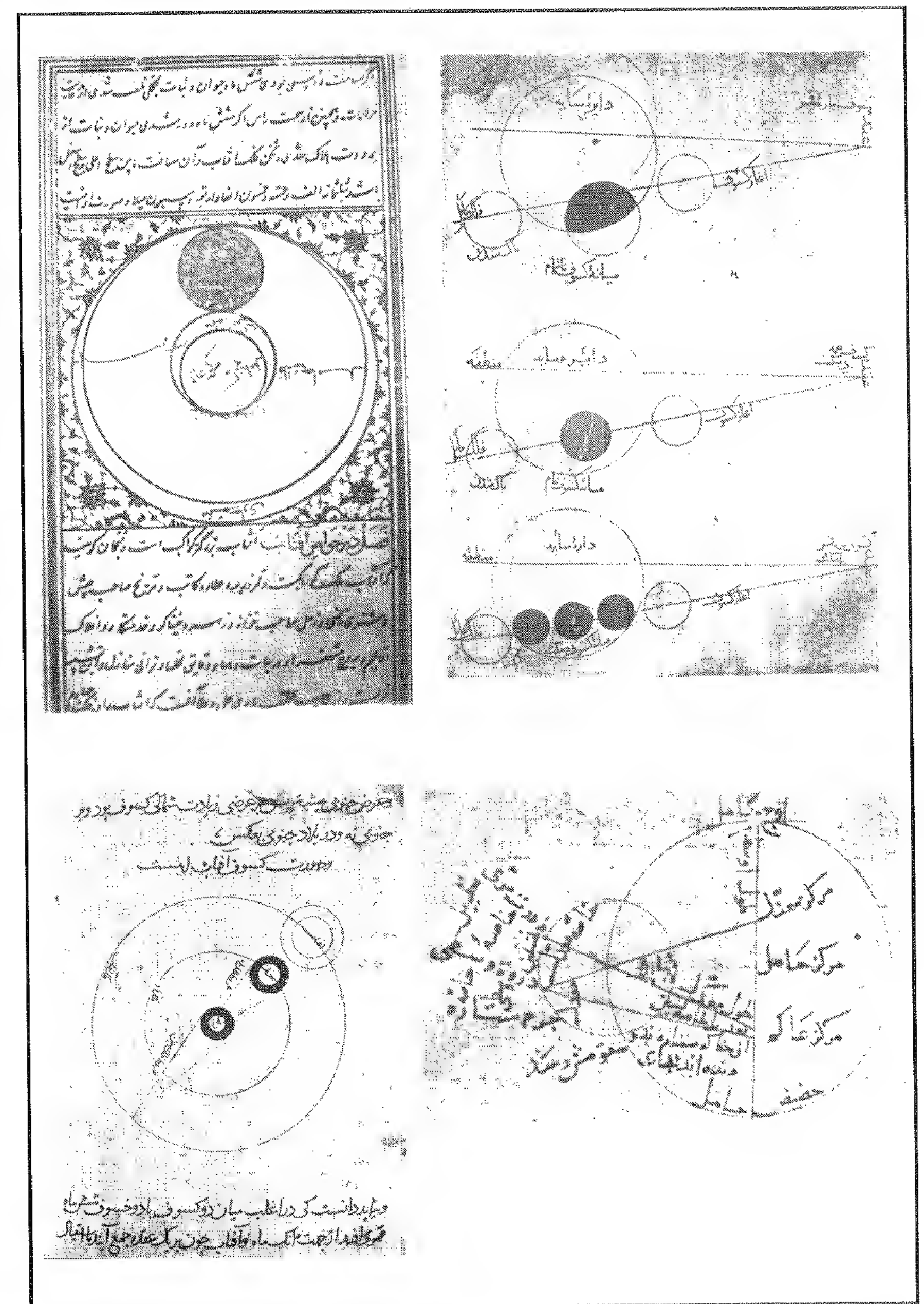
Diagram of Al-Biruni showing eclipses of the moon

## MUSA BIN SAKIR

Musa Bin Shakir was initially a highwayman (robber) and was very active on the Khurasan area in Iran. He was very courageous and very skillful in his undertaking. He always dressed in a soldier's uniform. He used to appear at mosque before and after every raid. In later part of his life, he reformed and Allah ﷻ compensated him. He became a well-known astrologer and joined the Court of al-Ma'mun (813 – 833 CE).

According to medieval sources available, Musa Bin Sakir had 3 sons namely Muhammad, Ahmed and Hassan. Upon his death, he left his sons under the care of the caliph who in turn entrusted them to Ishaq Bin Ibrahim al-Mus'abi, a retired governor of Baghdad. The children were placed under the tutelage of Yahya Bin Abu Mansur, an astrologer at Bayt al-Hikmah, a famous library and translation center patronized by Caliph al-Ma'mun.

The Caliph took great interest in the progress made by the children of Musa. By Allah ﷻ, the children made great

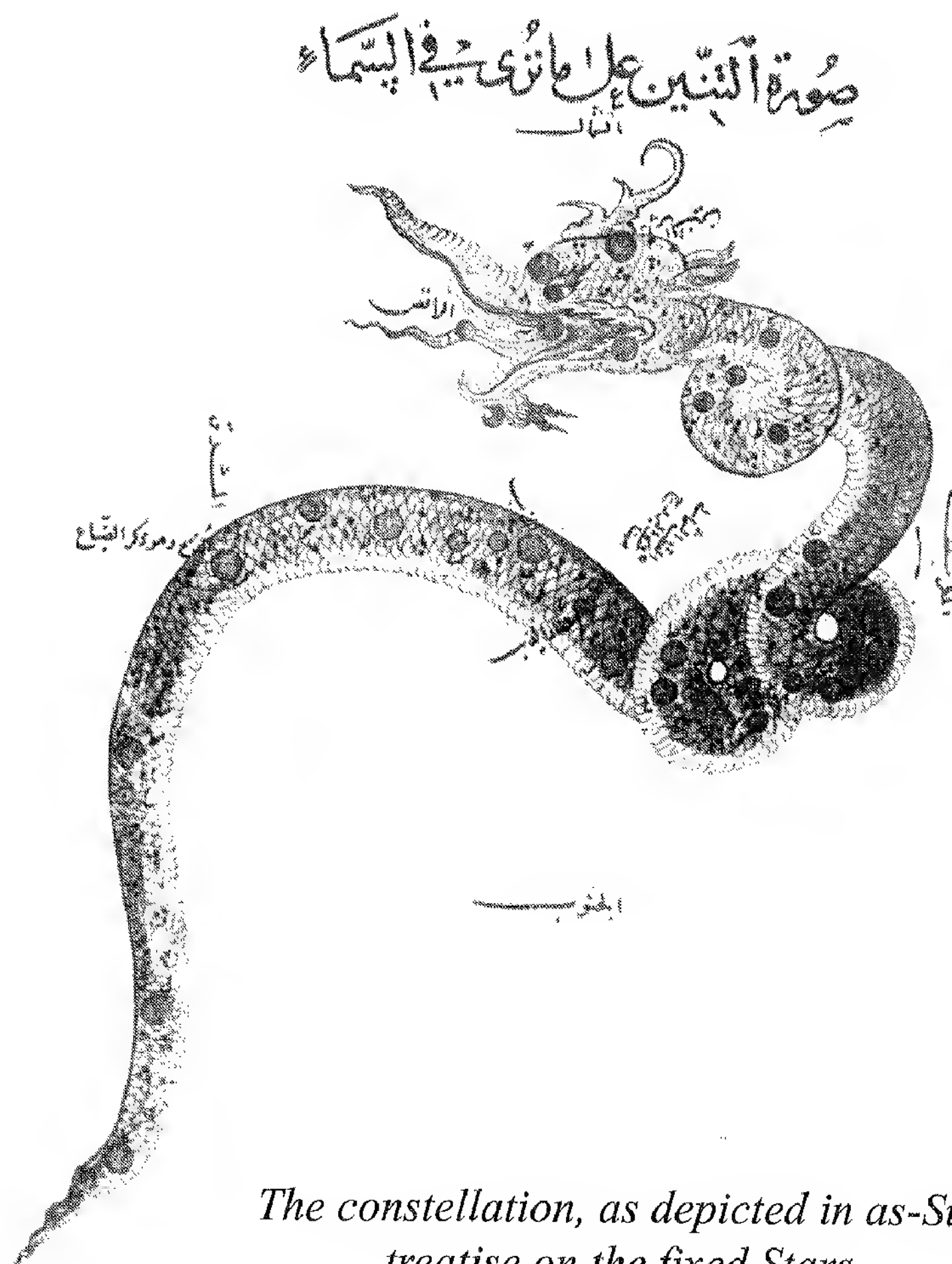


Planetary model and diagrams showing eclipses of sun and moon by al-Biruni.



achievements. Muhammad, the eldest learned geometry and astronomy. Ahmed excelled in mathematics whereas Hassan was deeply interested in geometry. Among the major contributions of Ahmed is a treatise on mechanical device, his demonstration on the non-existence of the ninth sphere, on the origin of the world, and on the atom.

The children of Musa are credited for their contribution collectively. Their works are on the measurement of plane and spherical figures, on determining two mean proportions, on the trisection of angles and "*Recension of Appolonius' Conic*".



*The constellation, as depicted in as-Sufi treatise on the fixed Stars.*

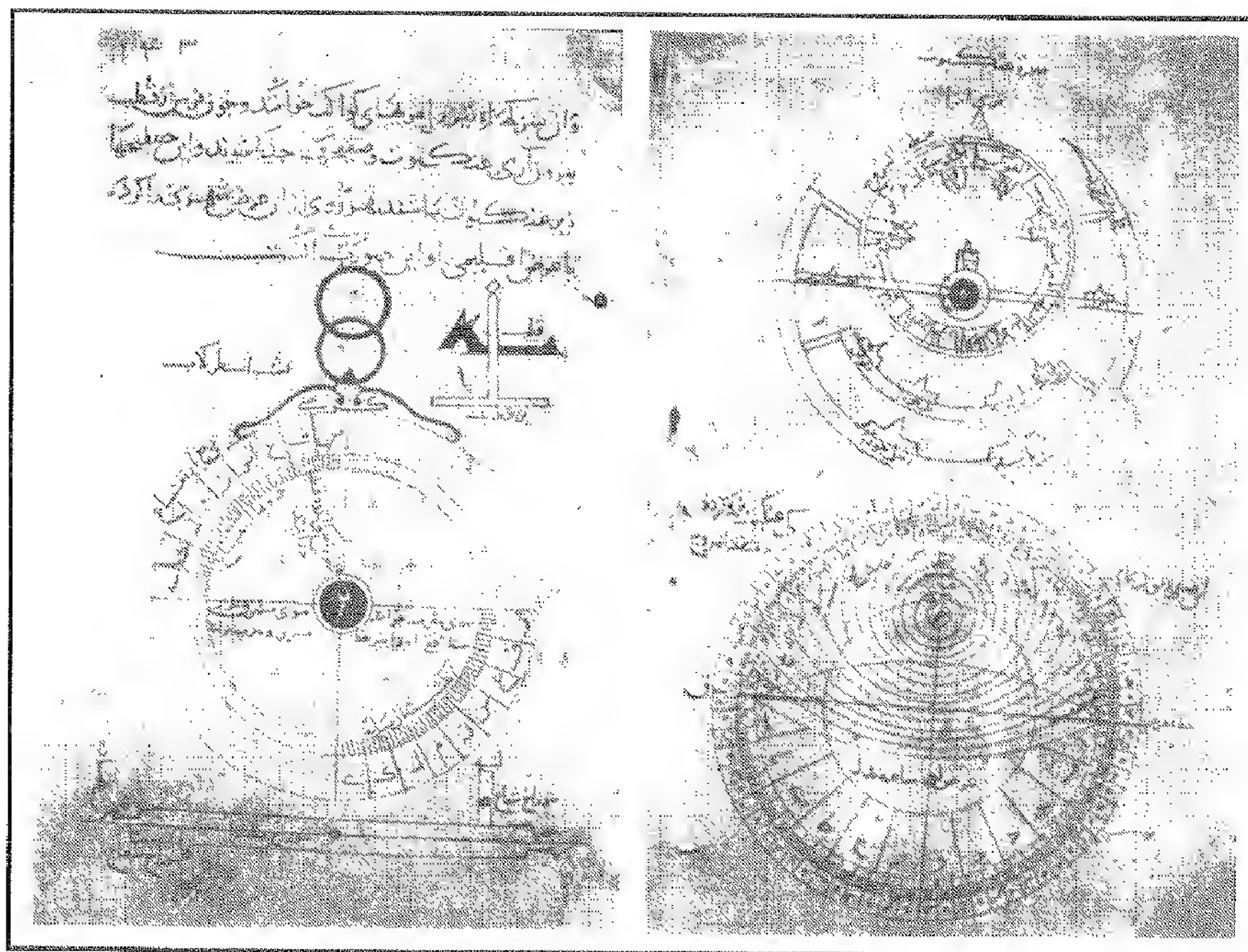
The book, "*Recension of Appolonius' Conic*" (this book is still in existence) is based on a translation made by Hilal Bin Abu Hilal al-Himsi under the guidance of Ahmed and Thabit Bin Qurrah. Historically, the most important work of the children of Musa is the treatise on the measurement of Plane and spherical figures. This work constituted an important development of "*Archimedes*" works on the measurement of circles, spheres and cylinders.

During the 12<sup>th</sup> century, a Latin translator, Gerard of Gremona translated the works of Muhammad, Ahmed and Hassan. This translation is known as "*Liber Trium Fractrum De Geometria*" or "*Verba Filiorum Moysi Filii Sekir*". In the translation, he referred Muhammad, Ahmed and Hassan as Maumeti, Hameti Hasen respectively and mentioned that they played a vital role in transmitting *Archimedean ideas and methods* to Europe. This translation was also known to have influenced the work of a 13<sup>th</sup> century mathematician, Leonordo Fibonacci of Pisa.

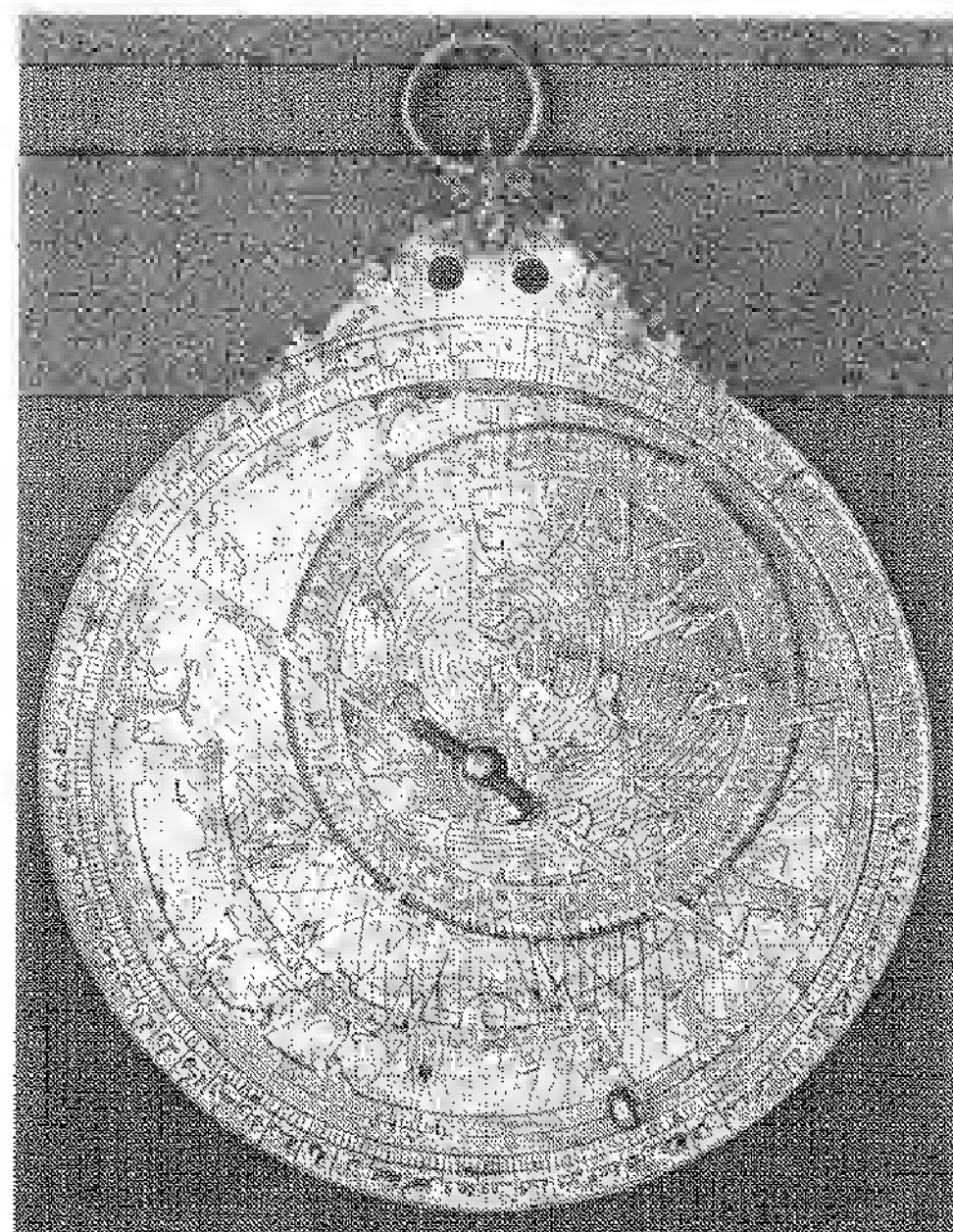
### **ABU al-HASAN THABIT BIN QURRAH as-SADI al-HARRANI**

Abu al-Hasan Thabit, a famous astronomer was introduced to the Caliph al-Mu'tadid (The Caliph after the death of Caliph al-Ma'mun) of Baghdad by Muhammad (son of Musa Bin Sakir). Abul al-Hasan converted to Islam and became renown for his works on astronomy, history, political science, mathematics and religion. The grandson of Thabit, Ibrahim Bin Sinan (died 946 AH) did great works in the fields of astronomy and geometry. He made important contributions in the field of scientific instrument, notable, a treatise on shadow instrument and a comprehensive work on sundials. The Qurrah family occupies a great position in the history of the Arabic civilization.





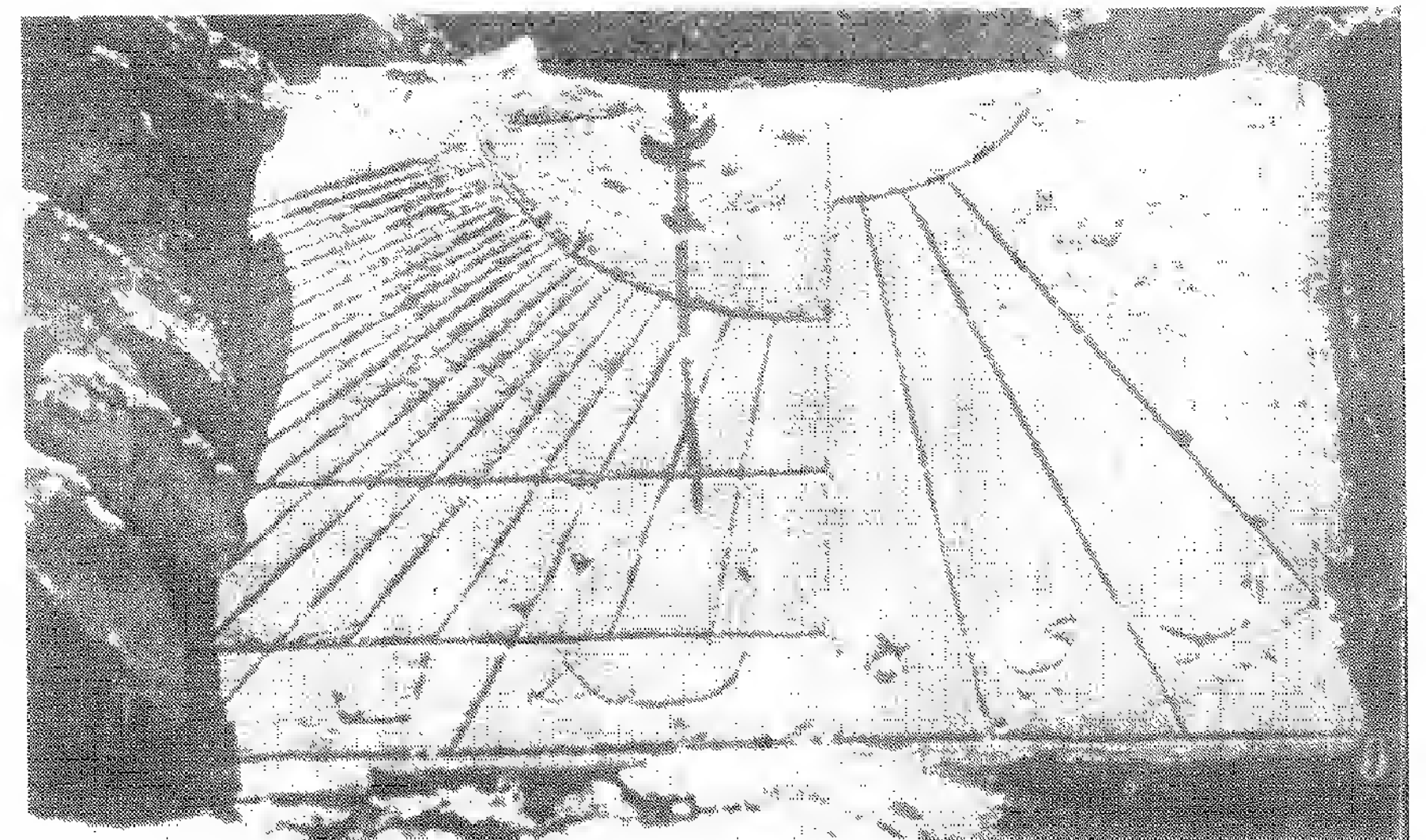
*Description of astrolabe according to al-Biruni.*



*Astrolabes from the Islamic world.*

## AHMAD al-NAHAMANDI (184 AH / 800 CE)

The earliest astronomical observation in the Islamic world dated back to 184 AH. It was when Ahmad al-Nahamandi observed the motion of the sun in Jundishapur in Persia. But, it took several centuries for his observatory to be brought into being as a distinct scientific institution.



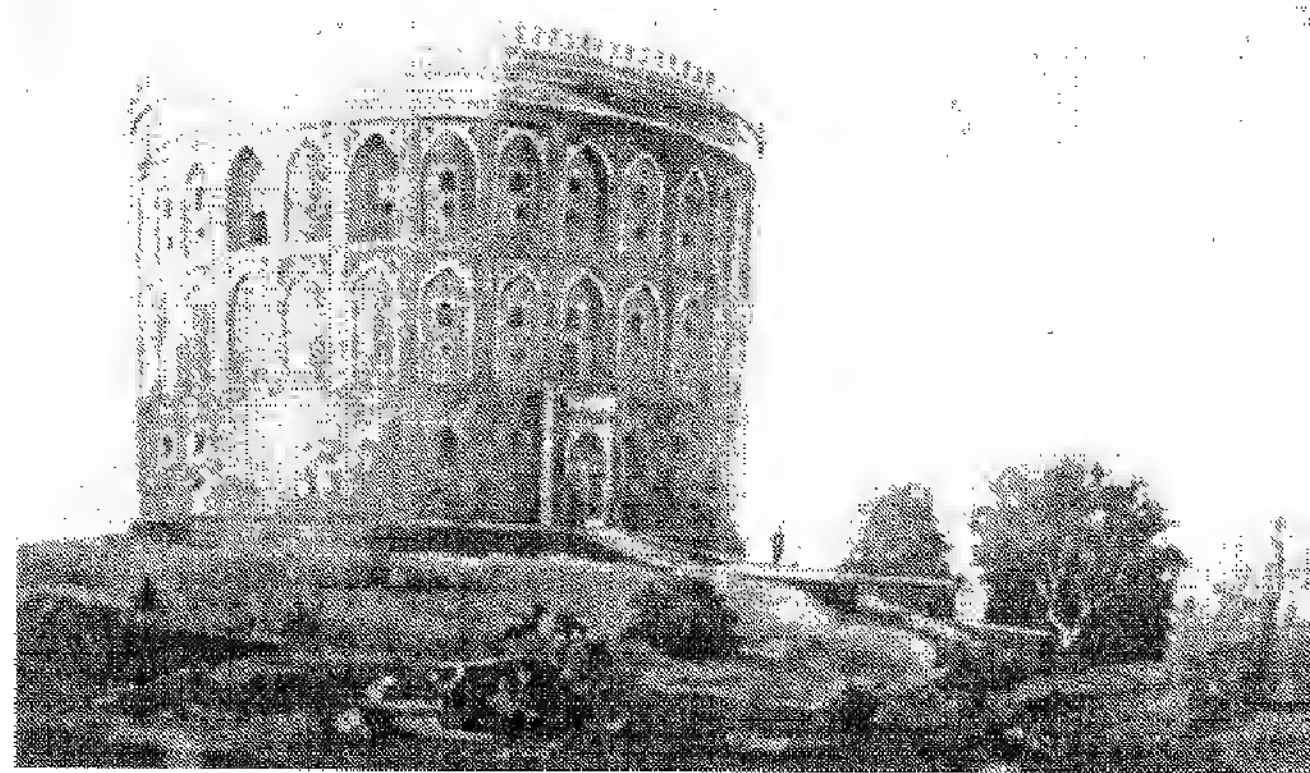
*A sundial from old Cairo Egypt*

## NASIR al-Din

In most Muslim cities, observatories were built. But, usually these observations fell ruined and went to disuse following the death of its astronomer or its patron.

Nasir al-Din was able to turn the observatory from an individual concern to a scientific institution in which a noteworthy group worked together. This institution did not depend on any individual for its survival. The first observatory known in history is the Maraghah observatory.





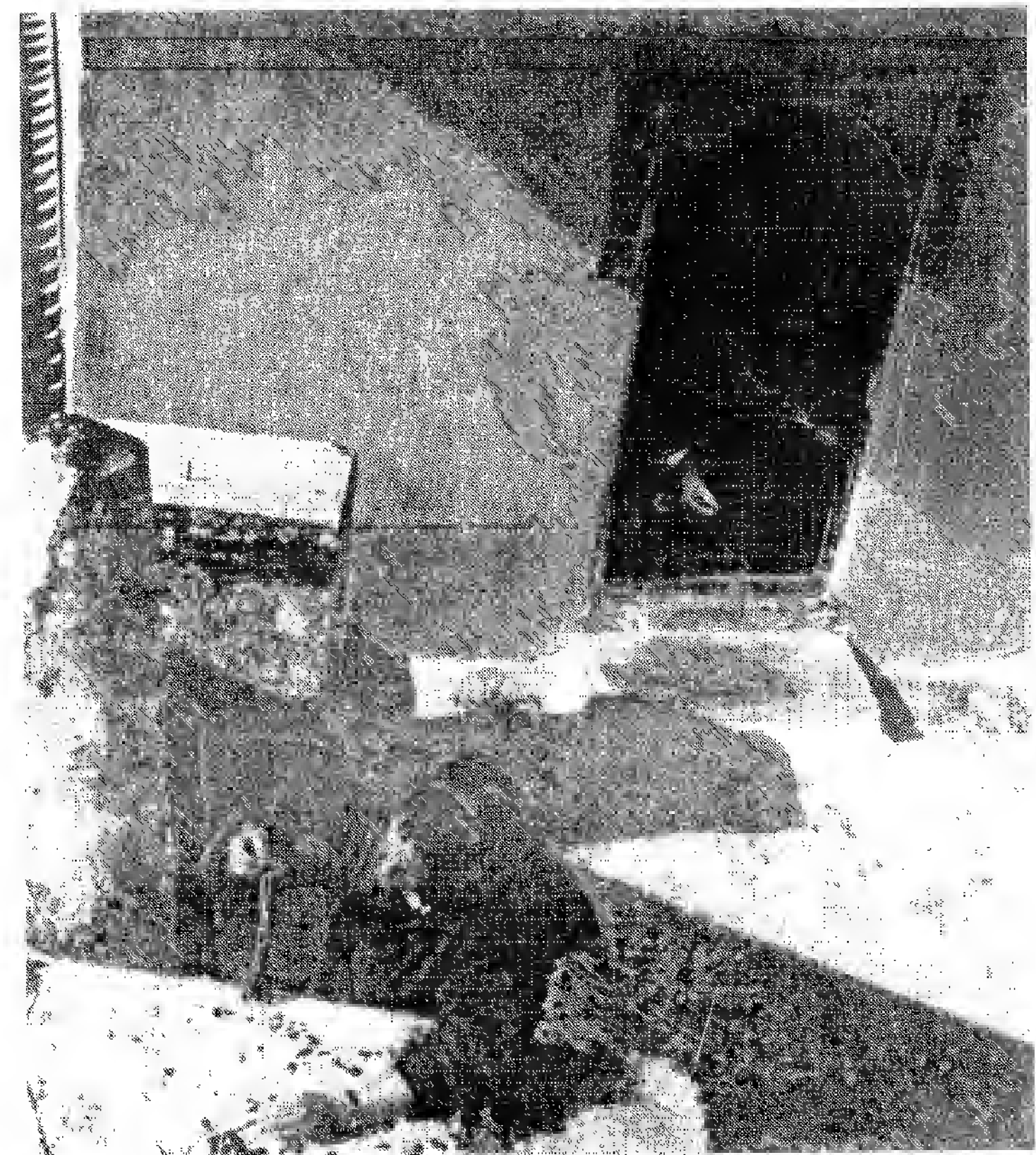
*A painting of the reconstruction of the Samarqand Observatory.*



*Remnants of the Samaeqand Observatory discovered in recent excavations.*

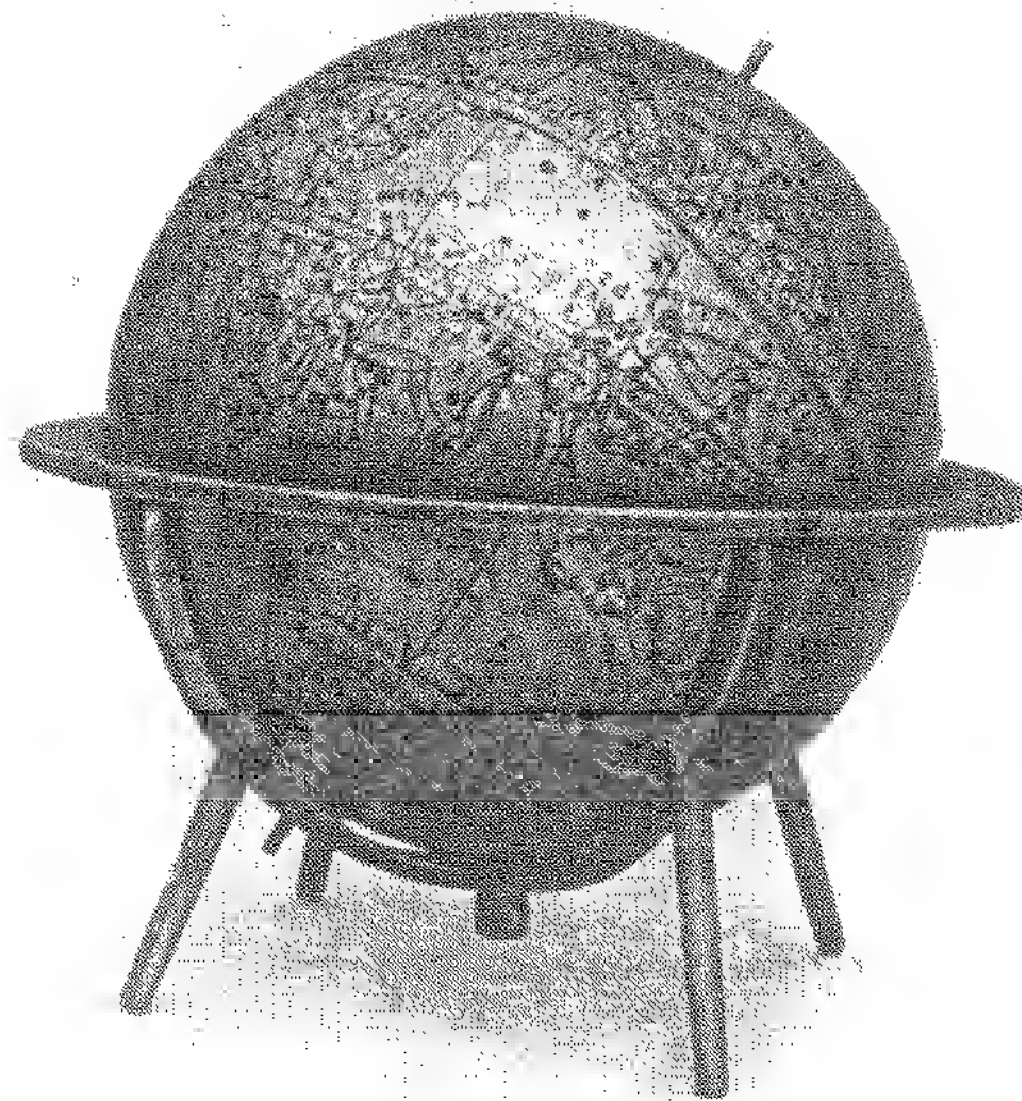
## TAQI al-DIN (983 AH / 1575 CE)

A major observatory was established in Istanbul by Taqi al-Din. Although it was short lived, it was of great importance. The Caliph, who was angered by certain predictions of his astrologers, ordered the destruction of the observatory. Basing on these observatories in Istanbul, Samarqand and Maraghah, major observatories such as Brahe and Kepler were constructed in the west. These observatories in the West were also equipped with similar equipments of those found in Muslim observatories. The most important achievement of Islamic science is the introduction of the observatory as a scientific institution to the world.



*A man determining from sundial in Morocco.*





*A spherical astrolabe.*

## MEDICINE

It is reported that when prophet Musa ؑ fell ill, a man of Banu Israel came to him, diagnosed his disease and said to him, *"If you use this medicine you will surely recover"*. Musa ؑ said, *"I will not take medicine and want to be cured without medicine"*. Then the man said to Musa ؑ, *"This is a well-known, experimented medicine for this disease, and we treat with this medicine"*. As a result, his illness aggravated even more.

Then Allah ﷻ revealed to him, **"By My Honour and Glory, I will not cure you till you use the medicine prescribed by the people"**. It is only then that Musa ؑ said to them, *"Give me the medicine you have prescribed for me"*.

By Allah ﷻ, he recovered after taking the medicine. This however raised doubt in his mind as to how the medicine cured him whilst he was invoking Allah ﷻ for cure. Allah ﷻ revealed to him, **"You want to baffle My laws by relying on Me. Who else except Myself created the quality of recovery in medicine?"**<sup>1</sup>

Jabir reported that Prophet Muhammad ﷺ had said, *"There is remedy for every malady, and when the remedy is applied to the disease it is cured with the permission of Allah, the Exalted and Glorious"*.<sup>2</sup>

Abu Darda ؓ once said, *"O prophet of Allah, if I'm cured of my sickness and I'm thankful for it, is it better if I were sick*

<sup>1</sup> This hadith is transmitted in al-Ghazali's *Ihya Ulum Iddin* (v.3 page 273)

<sup>2</sup> Muslim Ahadith, *Kitab as-Salam* v.3 page.1199



and bore it patiently?" The Prophet Muhammad ﷺ replied, "Verily, the Prophet of Allah loves sound health just as you do". The whole Islamic medicine is based on the injunctions contained in the Qur'an and the related *ahadiths*.

The aspects of Divine Law (*Shari'ah*) concerning personal hygiene, dietary habits, ablutions and many other elements affecting the body are related to medicine. Islamic Medicine and its allied subjects such as pharmacology, surgery etc drew their spiritual sustenance from the message of Islam and received their nourishment from the rich-soil of Graeco-Alexandrian, Indian and Persian medicine.

In the Muslim medical world, the physicians, philosophers and other masters in traditional sciences are called "*Hakim*". It must be noted that nearly all the regions of Muslim world have made some contributions towards enhancing the medical science.

## HOSPITALS

Al-Walid I was said to have created the first Islamic hospital in the 1<sup>st</sup> AH / 7<sup>th</sup> CE century. The first fully equipped hospital with the required facilities of the day was established by Harun al-Rashid in Baghdad in 2<sup>nd</sup> AH / 8<sup>th</sup> CE century.

It was a hospital that turned out to be pivot of medical activity and a center for Islamic medicine. A famous physician, Yuhanna ibn Masawayh headed the Baghdad hospital. This hospital served as a model for other numerous hospitals in Baghdad.

The other famous hospital is 'Adudi' was built by the Persian ruler, Adud al-Dawlah in the 4<sup>th</sup> AH / 10<sup>th</sup> CE century. Hospitals were built in many Muslim cities e.g. around Baghdad by Muhammad ibn Zakariya al-Razi, in Damascus and in Aleppo (an ancient city in Syria) by Nur al-Din al-Zanji during 6<sup>th</sup> AH / 12<sup>th</sup> CE century. In Cairo, Salah al-Din Ayyubi constructed the Nasiri hospital.

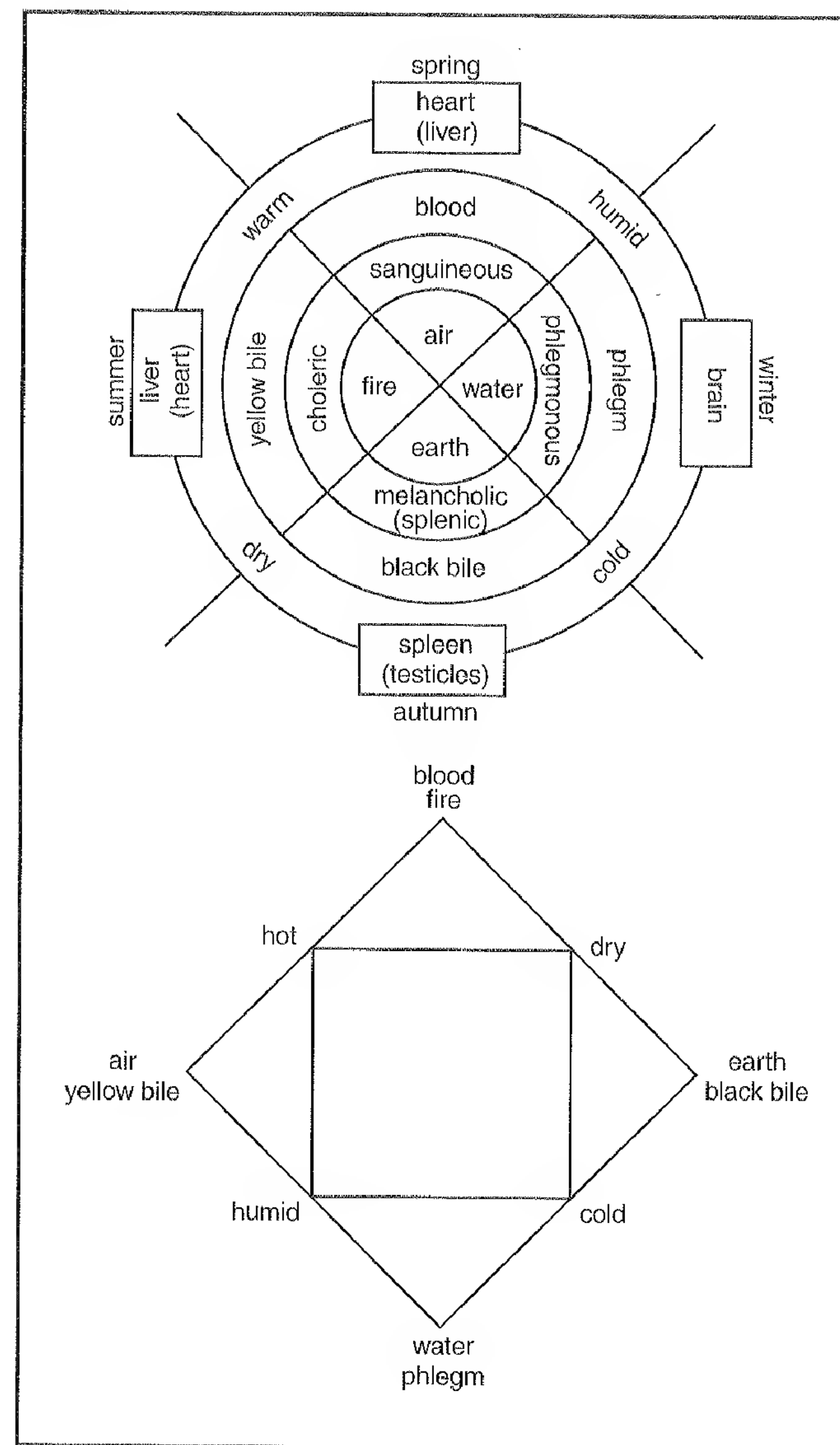
The most notable hospital built in Egypt was the *Mansuri* hospital. This was built by Mansur Qala'un in 7<sup>th</sup> AH / 13<sup>th</sup> century from an old *Fatimid* palace. This hospital had beds for several thousand patients with different rooms specified for various illness and separate sections for males and females. It also had lecture halls, a library, a mosque and administrative quarters.

## NATURES and HUMOURS

Humours form the foundation of an animal and man's activities. There are four humours namely blood, phlegm, yellow bile and black bile. These humours are composed of elements and natures. Each humour is related to 2 natures and 2 elements and is of different qualities. Muslim physicians believe that in order to have a good health, 6 external factors are essential. These are usually called the "Six necessities". (*Sittah Daruriyyah*)

1. Air (including the effects of various climate soils)
2. Food (including times of meals, what should be eaten and drunk and their amount)
3. Bodily rest and movement (including exercise)
4. Sleep
5. Emotional rest (including the question of which emotional states help or harm health)
6. Exertion and retention (including the effects of sexual intercourse)

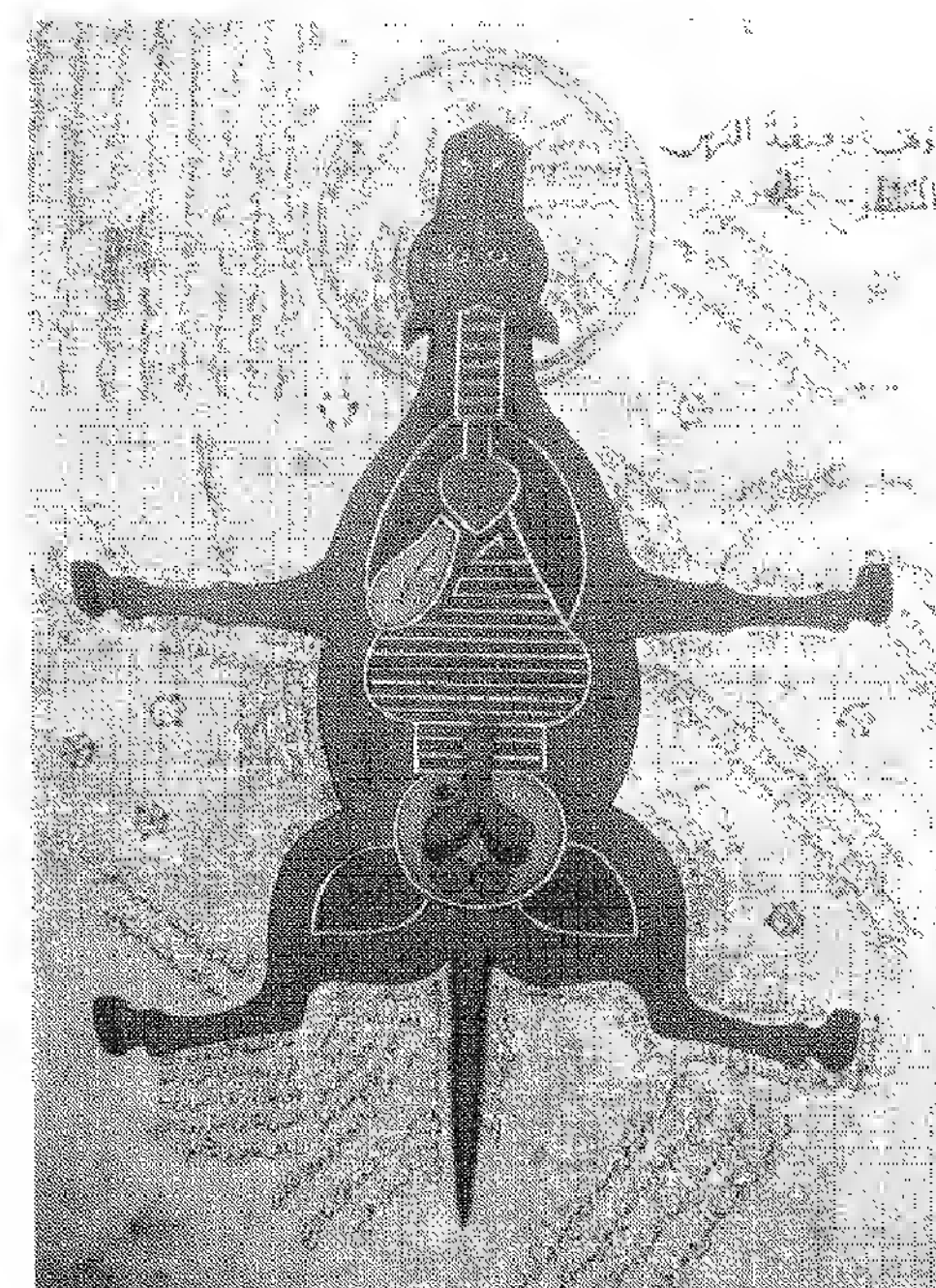




*The four natures of humours and the basic organs of the body in relation to the humours etc. according to the Jabirean corpus.*

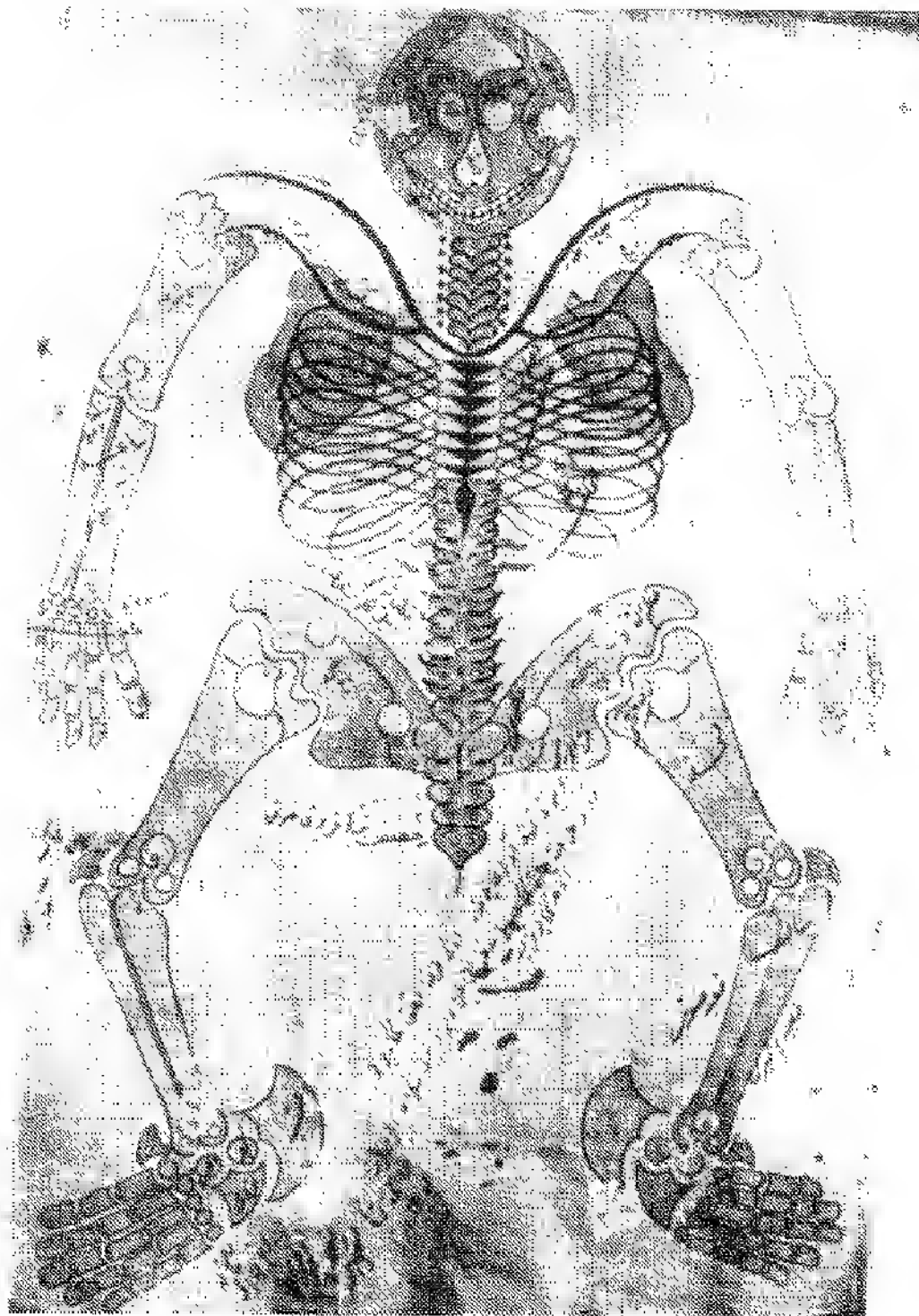
## ANATOMY

Anatomy is the science of the body structure of human, animals and plants. Muslims considered the study of the human body, the supreme creation of Allah ﷻ, as of prime importance for understanding the wisdom of Allah ﷻ. Famous scholars like Ikhwan al-Safa in his Epistles gave importance to the numerical symbolism of the parts of human body and their relations to the various cosmos.



*An Anatomical study of the horse.*





*Diagram on Islamic treatise of anatomy.*

Great philosophers like Al-Ghazzali, Ibn Arabi, Mulla Sadra also dealt extensively with the symbolism of human anatomy. Al-Farabi explained the theory of human society basing on the symbolism of human anatomy.

## HUMAYN IBN ISHAQ

Islamic world had some distinct physicians on ophthalmology (*Kahhal*). Muslims had inherited Greek and Alexandrian knowledge on this subject. Among the major Muslim physician on ophthalmology was Humayn ibn Ishaq.

Humayn ibn Ishaq's Latin name was Johanmitius. He was an Arabic scholar born in 808 CE near Baghdad and died in 873 CE.



*An ophthalmologic diagram of the eye from one of hunayn's ten treatises on the eye.*

With the experiences and knowledge of various Muslim ophthalmologists and oculists, this branch of Islamic medicine was further improved. This further leads to emergence of few famous ophthalmology like Christian Oculist, Ali Ibn Isa – the author of the famous Arabic treatise on ophthalmology called *Tadhkirat al-Kahhalin* (Treasury for Ophthalmologists).

## AL-JURJANI

Many technical terms on ophthalmology found in Latin and modern European language are from Arabic origin. These attest the influence of Islamic sources on this science. Towards east, works of famous men like Al-Jurjani spread to India. In India, practices such as couching for the treatment of cataract are survived to the present day.

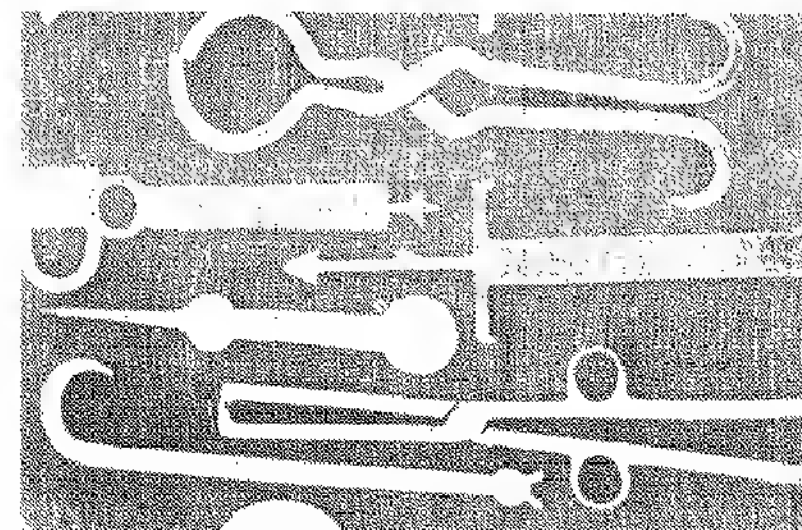


## QASIM al-ZAHRAWI

Qasim al-Zahrawi is better known as Albucasis in the West. The Muslim physicians usually disapprove surgery when there is no absolute necessity. Most of the instruments used in surgery are described in Abul Qasim al-Zahrawi's works. This marks the peak of surgery in Islam. Cauterisation in surgery was used not only for destroying infection around a wound but also for problems such as hemorrhoids.

History has noted that in Islamic medicine treatment for most cases of broken and disjunct parts of the body are not operated but were treated by means of external pressure applied to the affected parts. This would revert the dislocated parts to the original position and even to set the broken bones. This great art of external pressure by Muslims is still being used even to this present day by modern physicians in many parts of Islamic world. Muslim physicians can even treat major fractures like broken and disjunct shoulders; perform various operations on the mouth for treating the teeth. They even made false teeth from bones of animals.

*Surgical instruments  
of the Islamic world  
from al-Zahrawi.*



*Muslim physicians  
treating a female  
patient.*



*A patient with haemorrhoids being treated.*



*A dislocated shoulder being set.*



*A dentist at work.*



## ABU BAKR al-RAZI (684 CE – 930 CE)

Abu Bakr Muhammad Ibn Zakaria is the celebrated Muslim physician, physicist, alchemists, psychologist and philosopher. He is called al-Razi because of his birthplace Rayy, a town near modern Tehran. As a physician, he is, sometimes ranked even higher than Ibn Sina. According to Max Meyerhof, he is undoubtedly the greatest physician of the Islamic world and one of the great physician of all times.

A modern reader will keenly admire his minute observations, acute analyses and precise scientific explanations in his medical treatise especially on smallpox and measles. A medical literature that is of great treasure to the Arabs is "*Kitab fi al-Judari al-Hasbah*" written by al-Razi. This book was published about 35 times in various European languages between 15<sup>th</sup> and 18<sup>th</sup> century alone, not to mention modern re-publishing and spread of this famous work.

### Al-Razi's description of smallpox

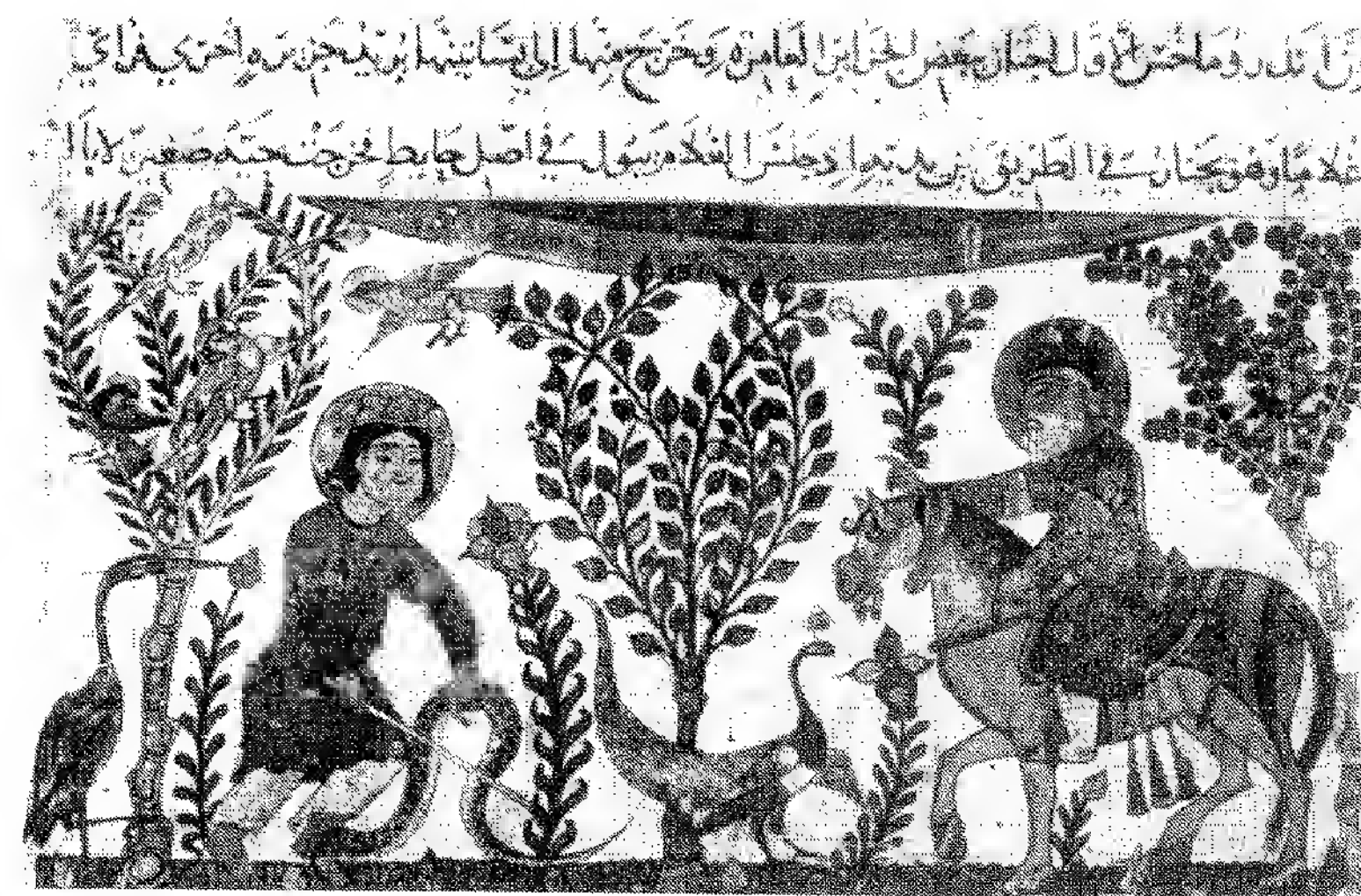
*The eruption of smallpox is proceeded by continued fever, pain in the back, itching in the nose, and terrors in sleep. These, especially the pain in the back with fever, are the more peculiar symptoms. The patient would have a pricking feeling all over his body, a fullness of the face that disappears and appears again. An inflamed colour and vehement redness in both the cheeks. A redness of both eyes, a heaviness of the whole body.*

*Great uneasiness, when stretching and yawning. Pain in the throat and chest with a slight difficulty in breathing and cough. A dryness of the mouth, thick spittle and hoarseness of the voice. Pain and heaviness of the head. Worry, distress of mind, nausea and anxiety. Heat of the whole body, an inflamed colour, and shining redness, especially an intense redness of the gums.*

*When someone experiences these symptoms especially the back pain and terror in sleep with continuous fever, then it is most probably that person would be affected by smallpox. On comparison, in measles the back pain is not that severe as in smallpox. The distention of the large vein and artery which are situated near the vertebrae of the spine, causes the back pain. Patient suffering in measles would face greater degree of nausea compared to smallpox. Unless the smallpox is of a bad type. This shows that the measles is bilious blood.*

## IBN RUSHD

Ibn Rushd (Averroes) is a Spanish Muslim Physician and a widely known philosopher. He was born in 1126 in Cordova and died in Morocco in 1198. In his "*al-Kulliyah fi al-Tibb*" (Generalities on Medicine), he recognized that no one is taken twice by smallpox. He also detailed the function of retina that receives images and transmit them to the brain.



*An illustration from the Book of Antidotes.  
A physician is curing a boy from snakebite.*



## IBN al-KATIB

Ibn al-Khatib (1313 – 1364 CE) lived during the time when the “Black Death” was ravaging Europe and Asia.

In a remarkable treatise, he recognized the contagious danger of the disease and defended his theory against theologians and fellow practitioners. Before this, the medieval man stood helpless, considering this disease as an “*act of god*”

## MUSLIM PHYSICIAN SUPERIORITY OVER THE CRUSADERS

Among the other things told by Usamah Ibn-Munqidh (1188 CE) to illustrate the inferiority of western culture as represented by the Crusaders, is the following: -

**Their curious medication:** The Lord of *al-Munaytirah*<sup>3</sup> wrote to my (Usamah’s) uncle asking him to dispatch a physician to treat certain sick persons among his people. So my uncle sent him a physician named Thabit. After a short period of ten days Thabit returned. My uncle asked Thabit, “*How did you managed to treat your patient during this short period*”.

Thabit replied, “They brought me before a knight in whose leg an abscess had grown and a woman affected with imbecility. To the knight, I applied a small poultice until the abscess opened and become well. For the woman, I put her on diet and made her humour wet. Then a Frankish Physician came to them and said, “This man knows nothing about treating them”. He, then asked the knight, “Which you prefer, living with one leg or dying with two legs”. The knight replied, “Living with one leg”. That Frankish physician asked, “Bring me a strong knight and a sharp axe”. A knight came with an axe. Then the physician laid the leg

of the patient on a block of wood and ordered the knight to chop off the patient’s leg in one blow. But, the leg was not severed in one blow. The knight continued to give another blow. This made the marrow of the leg to flow out and the patient died on the spot”.

“The Frankish physician then examined the woman and said, “*This is a woman in whose head there is a devil, which has possessed her. Shave off her hair*”. Accordingly her head was shaved. The woman also began to eat her ordinary diet of garlic and mustard. As a result, her imbecility took a turn for worse. The Frankish physician then said, “The devil has penetrated through her head”. He took a razor and made a deep cruciform incision on her head. He peeled off the skin at the middle of the incision until the bone of the skull was exposed. He, then applied salt on it. The women died instantly”.

“Thereupon I asked them whether my services are still required. They replied in negative. I returned home realizing that the Frankish physician knew nothing about medical treatment.”

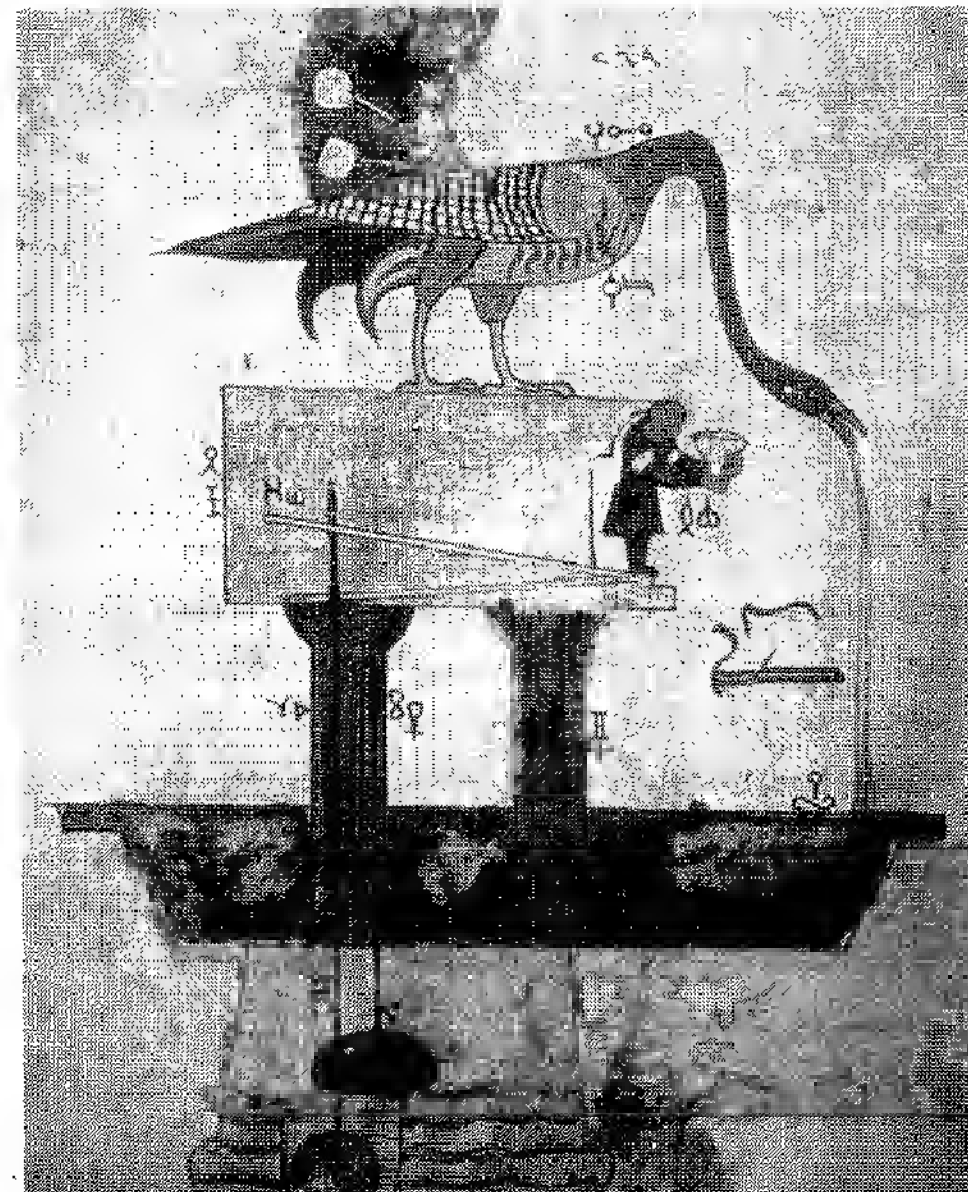
<sup>3</sup> In Lebanon near Afqah, the source of Nahr Ibrahim i.e. ancient Adonis



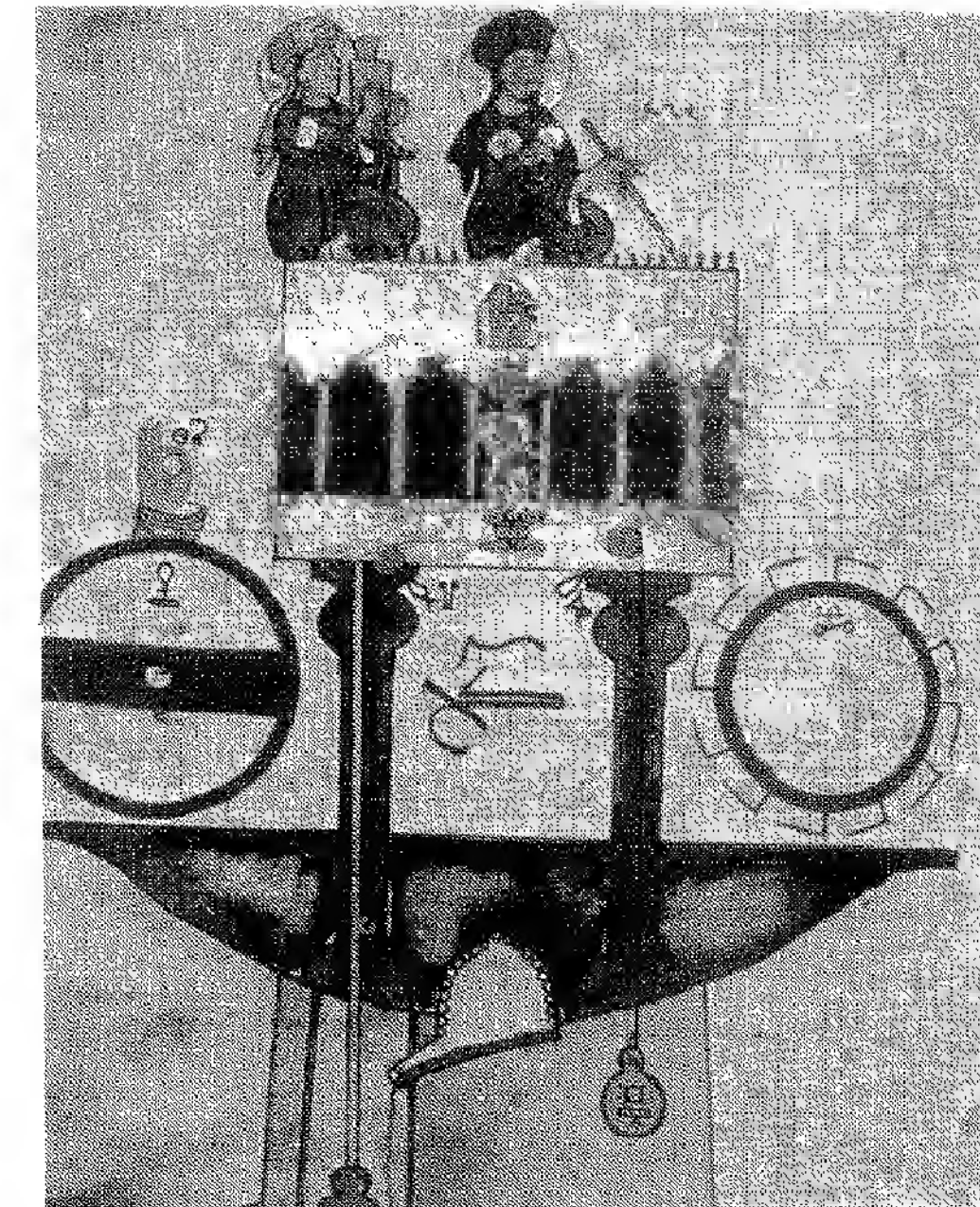
# PHYSICS

Sir Isaac Newton referred to himself as a natural philosopher and shared a common worldview with the Muslims scientists. In the Islamic sciences, there is natural philosophy (*tabi'iyat*) which included the life, the earth sciences, inclusive of physics and other sciences such as optics which are understood to be branches of physics. Muslims classified these as the mathematical sciences.

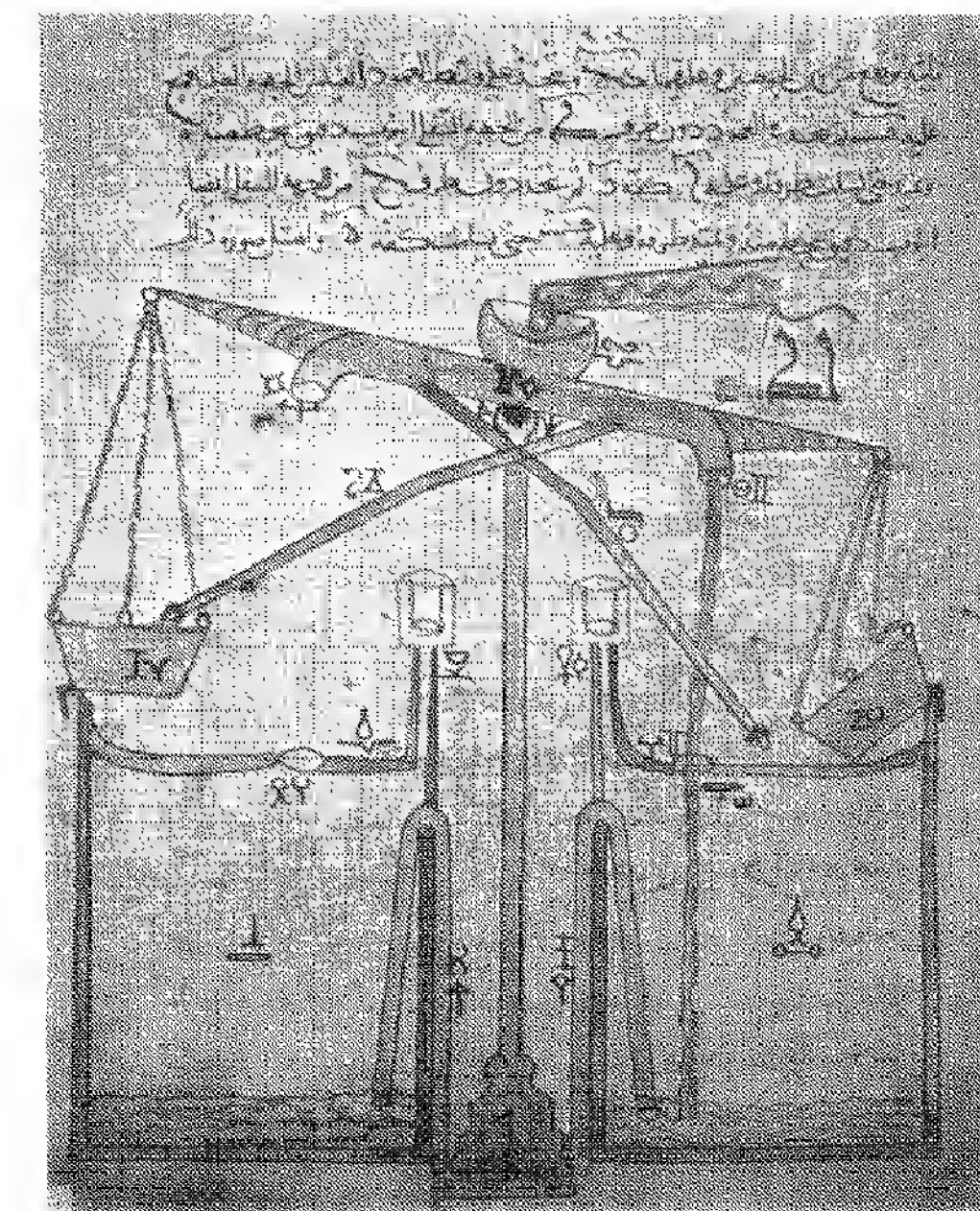
The principles of natural philosophy were in a treatise called "*fann al-sama al-tabii*" (Section dealing with what is heard



*Mechanical device from al-Jazari.*



*Mechanical device on physics by al-Jazari.*



*Mechanical balance by al-Jazari.*



concerning natural philosophy). In Islam, the most extensive detail is given by Ibn Sina in his 'Shifa'.

Nearly every Muslim philosopher, from al-Kindi to Mulla Sadra to Sabziwari, devoted a section of their writings to physics. In traditional doctrines, physics is an application of metaphysics. The principles of physics are to be found in meta-physics.

### IBN-BAJJAH (LATIN-AVEMPACE)

Aristotle asserted that there would be no way to stop projectile motion in a void. Contrary to this idea, Ibn Sina developed his work for projectile motion. He asserts that there is resistance such as air and is responsible for the *inclination* theory. This theory was further developed by Abul Barakat al-Baghdadi.

The second important concept that was developed by the Muslims is the concept of momentum called "*Quwwat al-harakah*", as described by Ibn al-Haytham in his "*Kitab al-manazir*" (Optical Thesaurus). Another Muslim's contribution that brightened the west is "*Avempacean Dynamics*". This is associated with the name of the Andalusian philosopher, Ibn Bajjah.

Ibn Bajjah, in his work criticised the Aristotelian theory of  $V = P/M$ , where  $V$  = Velocity,  $P$  = Motive power and  $M$  = the resisting medium. Galileo asserts that, in a vacuum where  $M=0$  the velocity does not become infinite.

Actually Galileo was basing upon the great works of Ibn Bajjah, who became known to the west through Ibn Rushd's comments of his views. Ibn Rushd was commending on book 4 of the physics of Aristotle.

### ABD al-RAHMAN al-KHAZINI

The *balance* (scale) was developed to measure specific weights using Archimedes principles. Al-Biruni is noted for his careful

measurements of the specific weights of several metals and minerals. Few other Muslims also wrote treaties on this subject e.g. Omar Khayyam's *Kitab al-Jawahir* and Abu Hatim al-Isfazari. But, the famous treatise is the *Kitab Mizan al-Hikmah* (Book of the balance of wisdom) by Abd al-Rahman al-Khazini.

This book evokes the idea of cosmic balance of Jabir ibn Hayyam. Al-Khazini used the Archimedes principle just like his predecessors such as al-Nayrizi and al-Biruni. He developed the *balance* as a refined instrument to measure specific weights. He also defines the effect of heat on the density of objects. Al-Khazini even developed a formula to determine the contents of gold and silver in an alloy of two metals.

### IBN HAYTHAM (965 CE – 1039 CE)

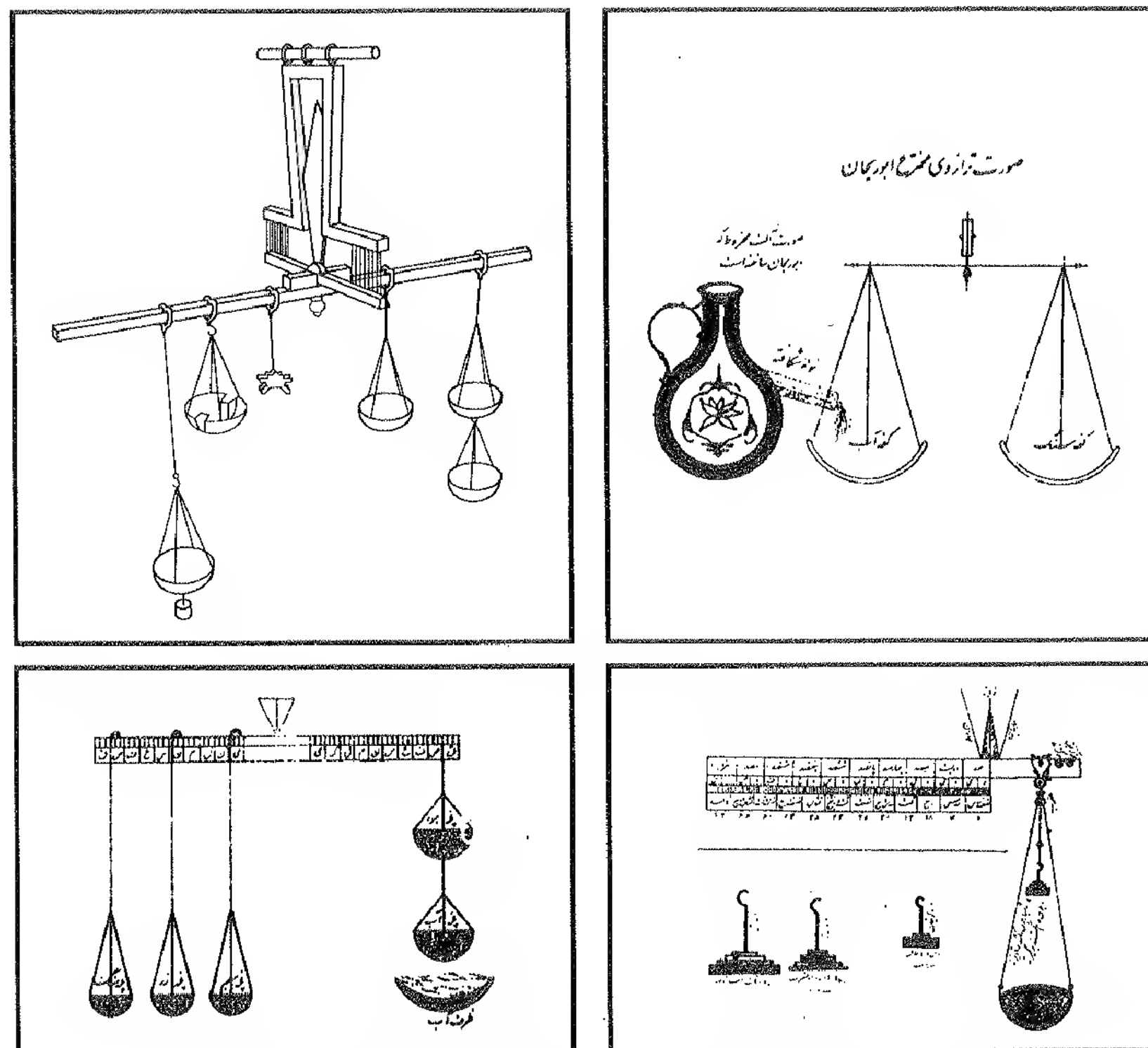
Abu Ali al-Hasan Ibnul Hasan ibn al-Haytham is a Muslim physicist, astronomer, mathematician, and physician born in the heyday of the Muslim scientific activity in 354AH in Basra.

In atmospheric phenomenon, Ibn Haytham's studies were of vital importance for both, astronomical observation and meteorology. He determined:-

1. The thickness of the atmosphere
2. The effect of atmosphere upon observing celestial phenomena
3. The beginning and the end of twilight
4. The reasons why the sun and the moon are larger on the horizon than in the middle sky and many optical effects.

He devised a lathe from which he made lenses for his experiments. For the first time, he studied the camera *obscura* mathematically. He is the first one who declared that light travels in a straight line and made experiments to prove this. Contemporary historians of science consider him as an





*Sketches of the balance made by al-Biruni.*

outstanding physicist. He was also a philosopher of grand respect, while performing experiments on light; he never forgot that “Allah ﷻ is the Light of Heavens and the Earth”.

Qutb al-Din al-Shirazi and Nasir al-Din discussed Ibn al-haytham’s views of his treatment of optics in his *Nihayat al-idrak*. Qutb al-Din himself made a special study of the rainbow and was the first to give a qualitatively correct explanation of it. Prior to the Muslims, Aristotle and Seneca had tried to explain the rainbow but were unsuccessful.

Qutb al-Din applied the optics of Ibn al-Haytham to explain the cause of the rainbow as a combination of reflection and refraction through drops of water. His own student, Kamal al-Din wrote the most important commentary of Ibn al-Haytham titled “*Tanqih al-Manazir*” (The Revision of the Optics).

He suspended a spherical glass in a dark room and studied the effects of the rays of light cast upon the sphere through a hole. He discovered that a primary rainbow is caused by two refractions and one reflection. Whereas, the secondary rainbow by two refractions and two reflections. Meanwhile, Theodore of Freibourg, a western scientist, also applied the fruits of Ibn al-Haytham’s discoveries to the problems of the rainbow. He also came to the same conclusion as of Kamal al-Din.



## GEOGRAPHY AND NAVIGATION

Like in other fields, Muslims also excelled in geography and navigation.

“*Suryasiddhanta*” and other Indian astronomical texts were translated into Arabic. This enables the Muslims to learn about the Indian geography. They also learned the calculation of longitudes. It is noted that Muslim sailors invented astrolabe, compass to determine their position and directions. The Arabic names of places such as “*bahr al-fars*” for Indian Ocean, the Persian Sea, ‘*Jaziratul Munawwarah*’ for Mauritius proves that Muslims are great adventurous and travelers.

The Arab navigations in the Indian Ocean were well before the Portuguese. The history has been forged and distorted. Mauritius was not discovered by the Portuguese but by the Arabs. There is a history book titled “*Kitab al-fawaid fi usul al-bahr wal-qawaid*” in which the Arab navigations are well recorded. Before the advent of European renaissance, Muslims made notable advances in nautical geography. Famous books like “*al-Undat al-Mahriyyah*” (The Pillars of al-Mahri) and “*Kitab al-fawaid fi usl ilm al-bahr wal-qawaid*” (The book of benefits concerning the principles and foundations of the science of sea) by Sulaiman al-Mahri Ibn Majid influenced the west. The west introduced meteorological terms like typhoon from the Arabic word “*Tufan*” and monsoon from “*Mawsim*”. Ibn Majid also



*The first scientific world map by Al-Idrisi.*

guided the ship of Vasco de Gama from Malini in East Africa to Calcutta in India.

In short, the voyages of European sailors would not have been possible without the instruments invented by the Arabs. It is interesting to note that Vasco de Gama reached the East Coast very much later than the Arabs in 1498. It was Ibn Majid who took him across the Indian Ocean to India. The adventures of *Sindbad the sailor* which were known to the western children are in fact based on the experiences of Arab captains' navigations.

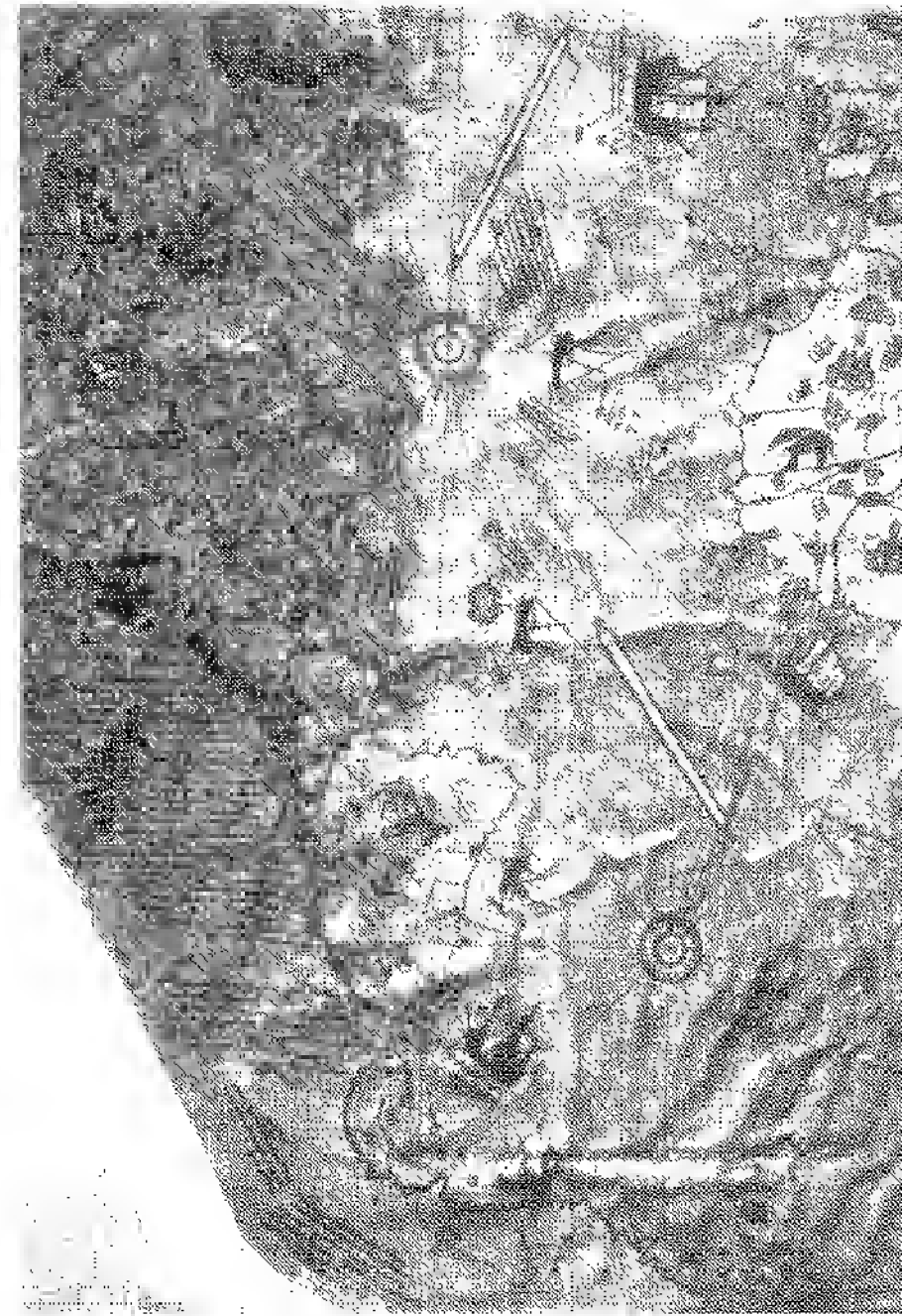
### SAYYID ALI AKBAR KHITAI

In his book, “*Khitay namah*”, he gave a fresh geographical description of the journey routes to China.

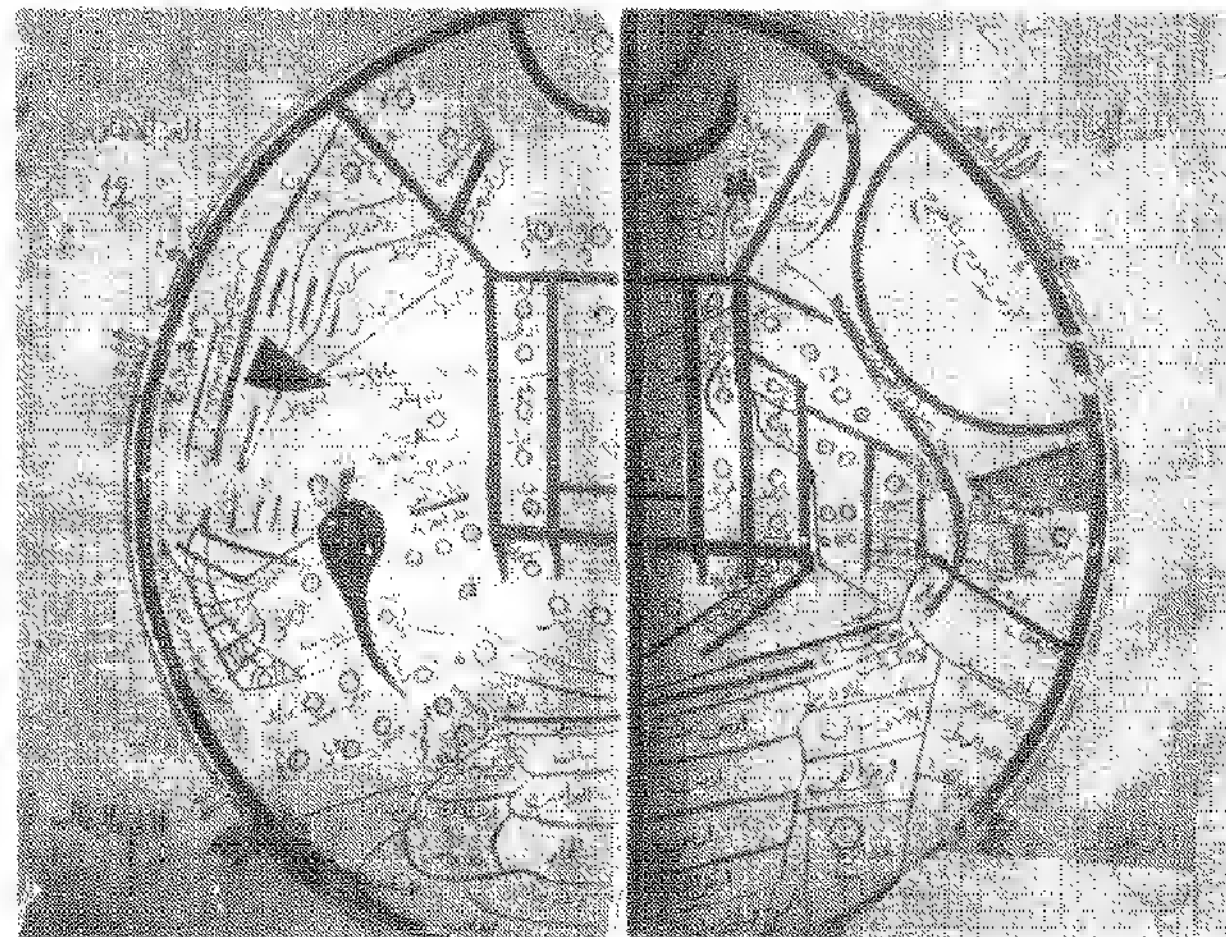


## PIR MUHYI al-DIN RAIS

The most shocking contribution of the Arab navigation is perhaps the cartographic works of Pir Muhyi. In his work dated 10 AH / 16 CE, he produced maps of Africa and America which are still surprising the modern scholars.



*The amazing map of America according to Piri Ra'is.*



*The Muslim lands of Western Asia according to the map of Kasgarli Mahmud.*

## ABU ABDALLAH al-IDRISI (1100CE – 1165CE)

Abu Abdallah al-Idrisi is a Moroccan geographer, scientist and author of the greatest geographic works of the medieval world.

From the 6<sup>th</sup> AH / 12 CE to the beginning of the European expansion (during the Renaissance), marks the period of elaboration and systematization in geography among Muslims. During this period, cosmographical encyclopedia such as *Nukhbat al-Dahr* (The Selection of Age) by Shams al-Din al-Dimashqi and *Ajaib al-Buldan* (The Wonders of the Lands) by Zakariyya al-Qazwini were made available. It was also this period that saw the original geographers such as Abul Fida and Abu Abdallah al-Idrisi. Abu Abdallah al-Idrisi who served at the court of Roger 2 in Sicily, dedicated a book, "*Kitab al-Rujari*" (The book of Roger) to Roger 2. The world map prepared by al-Idrisi, was based on the earlier Islamic sources. This marks the height of cartography in Islam.

## YAKUT

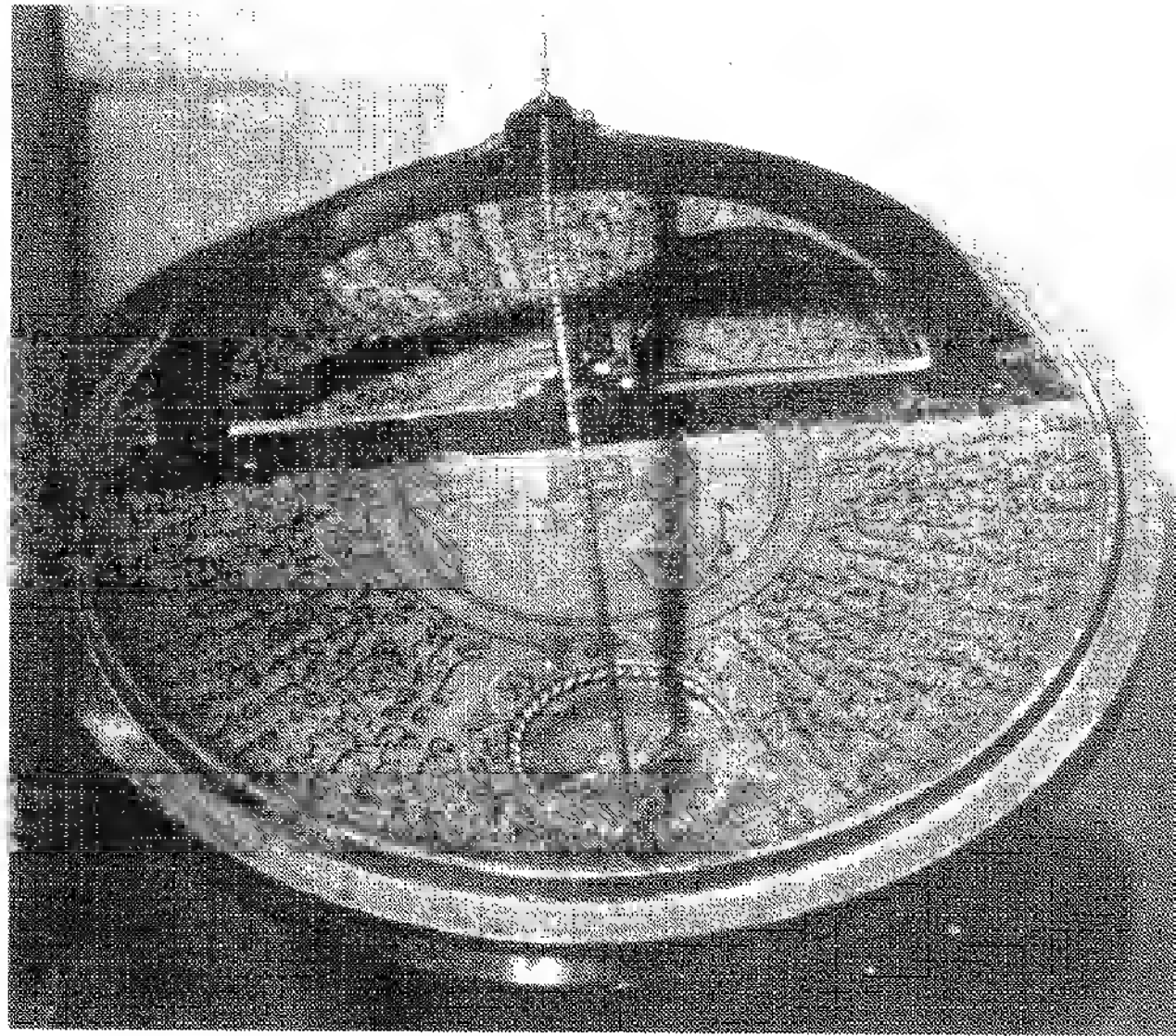
Yakut's contribution was on incomparable geographical dictionary entitled, "*Mu'jam al-Buldan*" (Dictionary of the Lands). This is still a vital archive and a tool for modern scholars.

## IBN BATTUTAH (1304 CE – 1369 CE)

Ibn Batuttah, a great traveler, was born in Tangier, Morocco.

He set out from Tangiers and traveled to Far East of India and China. In his remarkable, "*Tuhfat al-Muzzar*" (The Gift of observers, usually known as Travels), he provided the geographical and topographical information extensively. This book also has information on history, religion ethnography that made this book one of the most outstanding in the mediaeval period.





*An Ottoman compass.*

## GEOLOGY

### The World Soul

- Mineral Soul
- Vegetative Soul
- Animal Soul
- Power of Consolidation
- Power of Feeding
- Power of Production
- Power of Grow
- Power of Comprehension
- Power of Motion
- Power of Motion of Body
- Power of Desire
- Power of Anger
- Power of Lust

The home of the above kingdom is the earth. Muslim nature historians usually refer to the study of geology before discussing any of the three kingdoms namely *Mineral*, *Plant* and *Animal*. Muslim geologists in their works on mineralogy show a clear understanding of the gradual character of geological change, the major transformation, on the surface of the earth, including the changing of land into sea and vice versa.

Their works also disclosed many cataclysms such as violent earthquakes, which evidently transformed the sculpture of the



earth and the important of rocks that are the earth's geographical history. Al-Biruni, one of the foremost of Muslim's geologists writes, "We have rely on the records of rocks and vestiges of the past to infer that these changes should have taken place very very long time and under unknown conditions of cold and heat".<sup>4</sup>

He continued, "One of these plants is in India, limited in the south by the above-mentioned Indian Ocean, and on the three sides by lofty mountains, the waters of which flow down to it. But if you see the soil of India with your eyes and meditate on its nature, if you consider the rounded stones found in the earth however deeply you dig, stones that are huge near the mountains and where the rivers have violent current, stones that are of smaller size at the greater distance from the mountains and where the streams flow more slowly, stones that appear pulverized in the shape of sand where the stream begin to stagnant near their mouths near the sea. If you consider all these, you can scarcely help thinking that India was once a sea, which by degrees had been filled up by the alluvium of streams"<sup>5</sup>

Ibn Sina described carefully his own observation along the banks of River Oxus concerning the gradual petrification and solidification of clay, and explained the formation of sedimentary rocks correctly.

Muslim scientists also made scientific studies that are related to Hydrology, a science dealing with continental water on and under the earth's surface and in the atmosphere. In the work of al-Karaji, one observes that there are linked disciplines between practical knowledge and theoretical studies.

<sup>4</sup> Z. Validi Togan, Biruni's Picture of the World, Memoirs of the Archaeological Survey of India (vol. 53, Calcutta 1937 – 1738, page 57-58)

<sup>5</sup> AlBiruni's India Ed. Sachau page 198 vol. 1 6.N. Stat al-Hosri, Les Idee d'Avicenne sur la geologie. 'Millenarie d' Avicenne, Congress de Baghdad 1952 (page 454-463)

## MINERALOGY

Great works on mineralogy are branched to petrography, metallurgy and Alchemy. Even the term, "Hajr", meaning stone that used in many works also refers to the *Philosophers' Stone*.

The Muslims inherited a vast literature on mineralogy and the related fields from the Greeks, Persians and Indians. Works written by Islamic scientists and scholars on mineralogy dates back to 3<sup>rd</sup> AH / 9<sup>th</sup> CE century with two treaties by the philosopher scientist al-Kindi, *Risalah fi anwa al-jawahir al-thaminah wa ghayriha* (Treatise on various types of stones and jewels).



A page on the mineralogical section of a treatise on the *Ikhtiyarat-I-badi'd* of Ali ibn al-Husayn.



*Treatise on mineralogy by Zayn al-Attar.*

Al-Kindi also wrote an important treatise on metallurgy and the art of making swords. This is the first book of its kind in Arabic. In addition to this, there are several invaluable works on the minerals and stones by al-Jahiz, Nasr ibn Yaqub al-Dinawari, Muhammad ibn Zakatiyya al-Razi, the philosopher and physician Ikhwan al-Safa, who devoted one of their Epistles (leaflets in the form of letters) to it, and Muhammad ibn Ahmad al-Tamimi who wrote *Kitab al-Murshid* (The Guide book). This book was made reference book by the numerous authors later.

## BOTANY

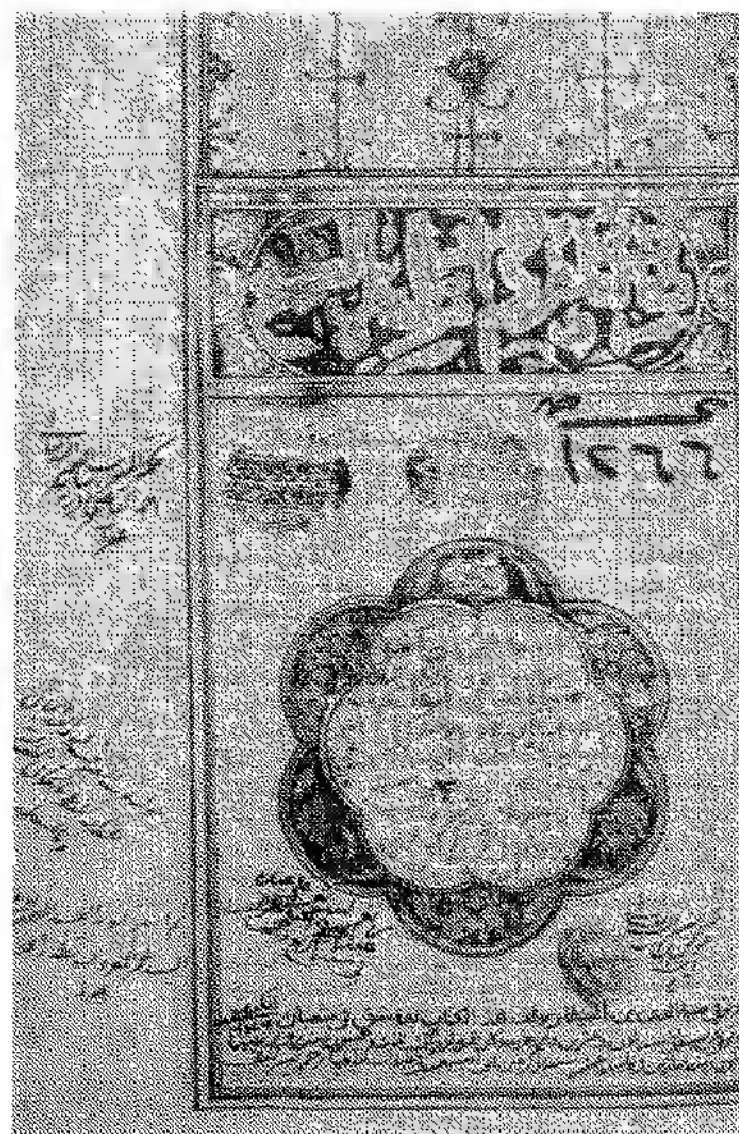
Islamic works on botany, science of plants, started in the 2<sup>nd</sup> AH / 8<sup>th</sup> CE century with the treatise of Jabir ibn Hayyan on botany and agriculture. There were philologists and grammarians of this period such as Abu Nadr ibn Shumayl, Abu Zayd al-Assari from Basra and Ibn al-Sikkit from Kufa who were interested in plants. They assembled informative works about the plants' morphology, properties and names. One of the works is *Kitab al-Nabat wa 'l-Shajar* (The book of plants and trees) by Abu Said al-Asma'i.

The most important botanical treatise of the 3<sup>rd</sup> AH / 9<sup>th</sup> CE is the *Kitab al-Nabat* (The Book of Plants) by Abu Hanifah al-Dinawari. This book details the philological, historical and botanical approach in the study of plants. This book contained descriptions of each specimen of plants.

In the later Islamic centuries, the most important works on botany appeared mainly in Persian, Arabic and occasionally in Urdu in the Indian sub-continent where the profusion of vegetation offered a new opportunity for the Muslim botany. Unfortunately, most of this later works have been neglected until recently. Even Muslim scholars from the Muslim countries are inclining to the western treaties on botany.

The spiritual significance of trees and flowers in Persian and Spanish garden; in Arabic and Persian poetry; in some aspects of Islamic art and in general life of the Muslims, are inseparable





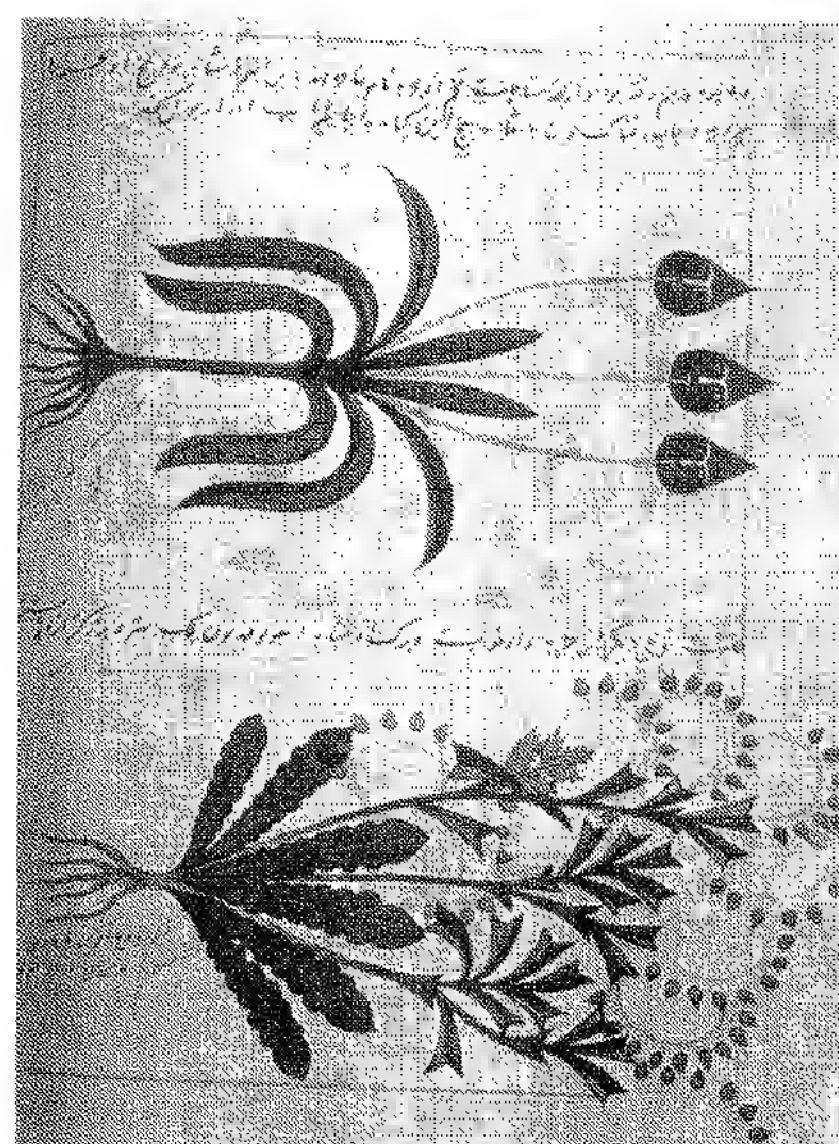
The opening page of the treatise on simple drugs by Ibn al-Baytar.



An illustration of a variety of sorrel.



Vine from a Persian botanical treatise.



An illustration of an anthropomorphic flower from a Persian botanical treatise.

from those aspects of botany which has medical properties.

These aspects together with the physical description to the esoteric significance of the tree of Paradise constitute the science of plants (*ilm al-Nabat*) and developed in the Muslims world over the centuries.

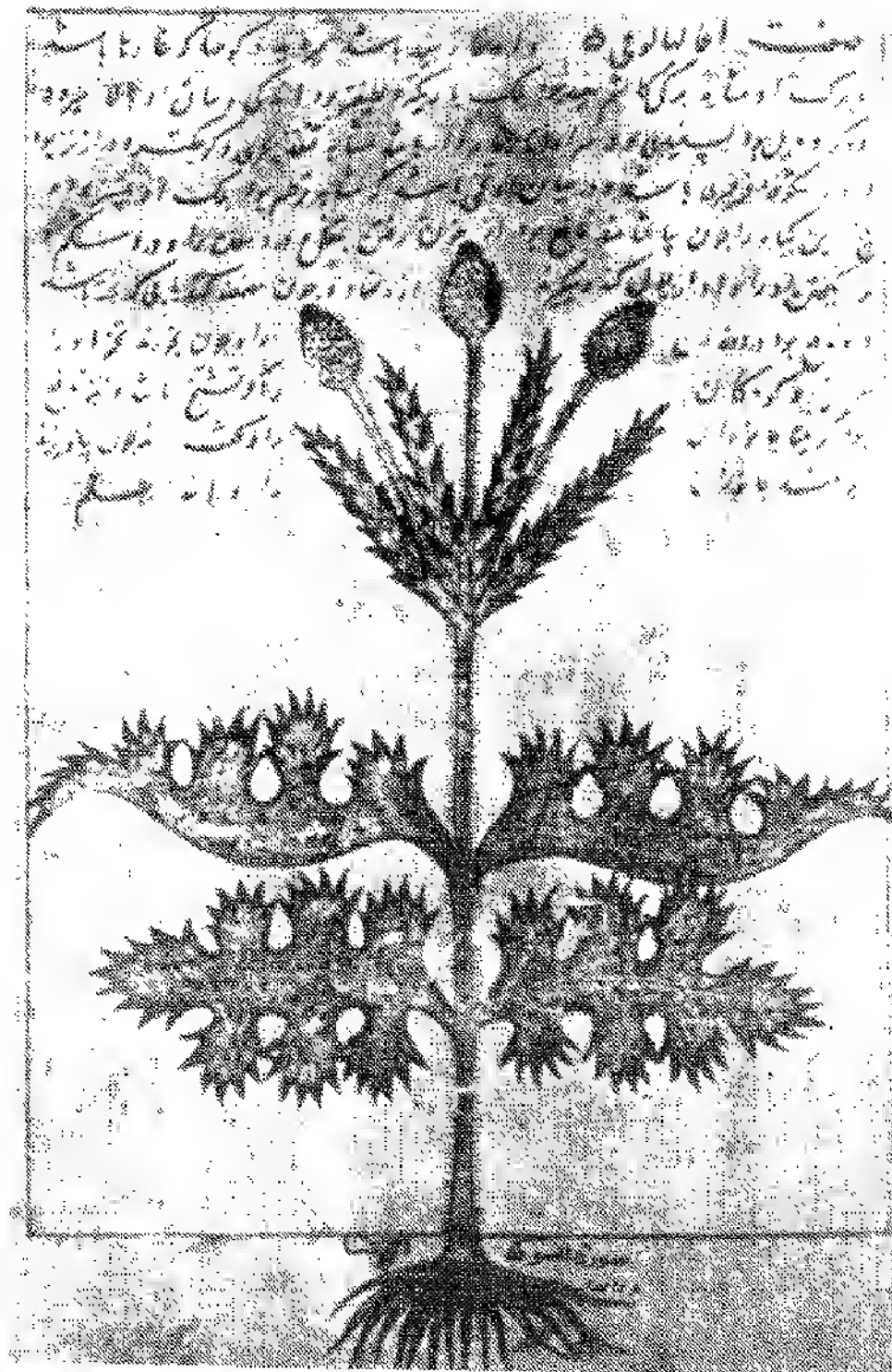
While, everyone is relying on the western methods of curing, Europeans are referring to the herbalists for cure. They preferred the old ways of herbal cure because modern pills, give rise to several side-effects and other diseases. And on the other hand, the Chinese herbal pills are flourishing in the western market.

Is there anyone to patron the dormant manuscripts of the Muslim scientists?



The tapping of a balsam tree.



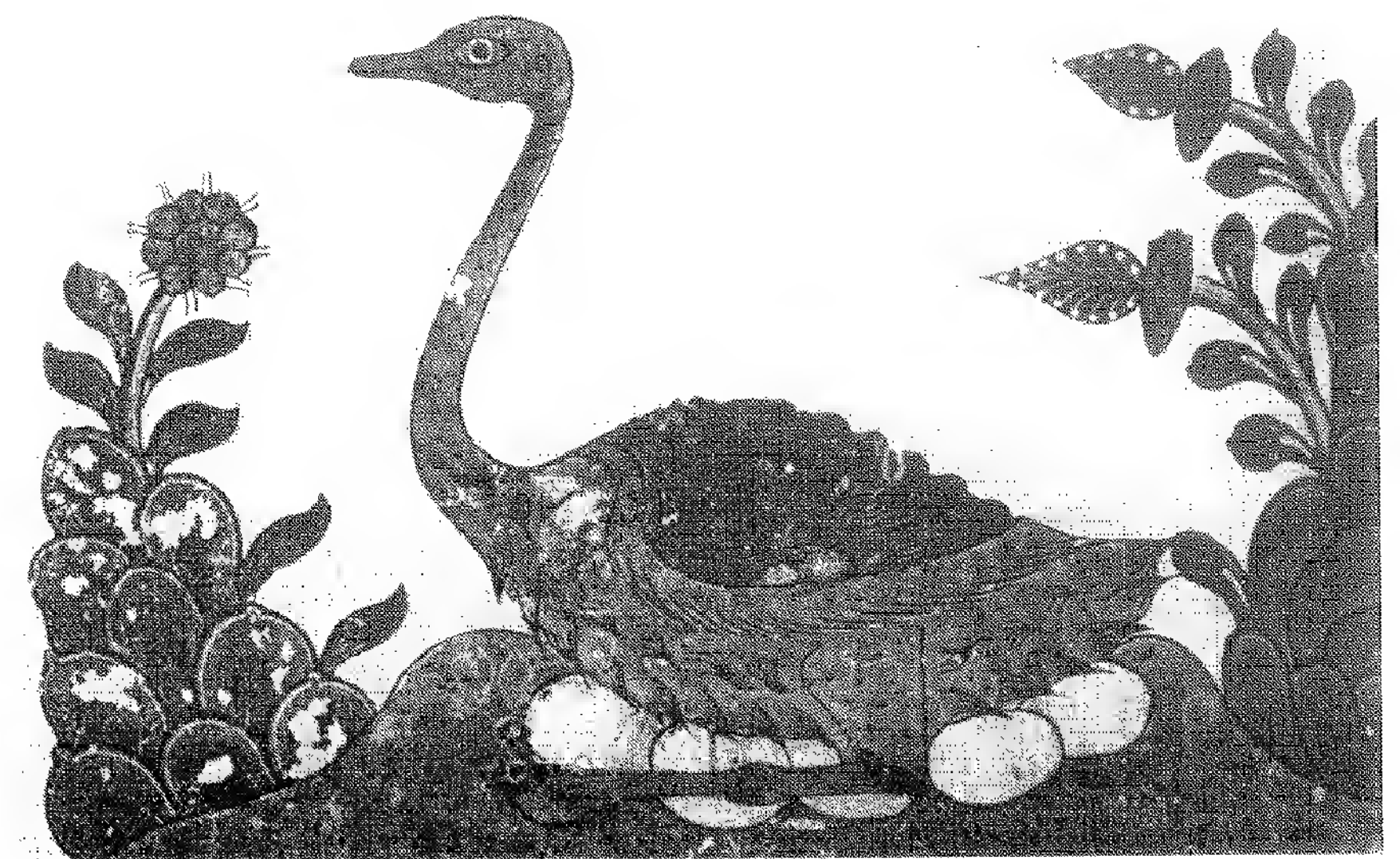


*An illustration of the thistle.*

## ZOOLOGY

The pre-Islamic Arabs already had some knowledge of animals such as the camels, and the horses. The act of sacrifice, through which a Muslim can only feed upon the animal kingdom, has sanctified animal life for Muslims. The injunctions in Shari'ah have placed many duties and responsibilities upon the shoulders of man in the good treatment of animals.

The main work on animal world is the *Kalilah wa Dimnah* (Tales of Bidpai), which became a major literary masterpiece of both Arabic and Persian. In the work of al-Jahiz, *Kitab al-Hayawan*, (The book of animals), he assembled all the knowledge

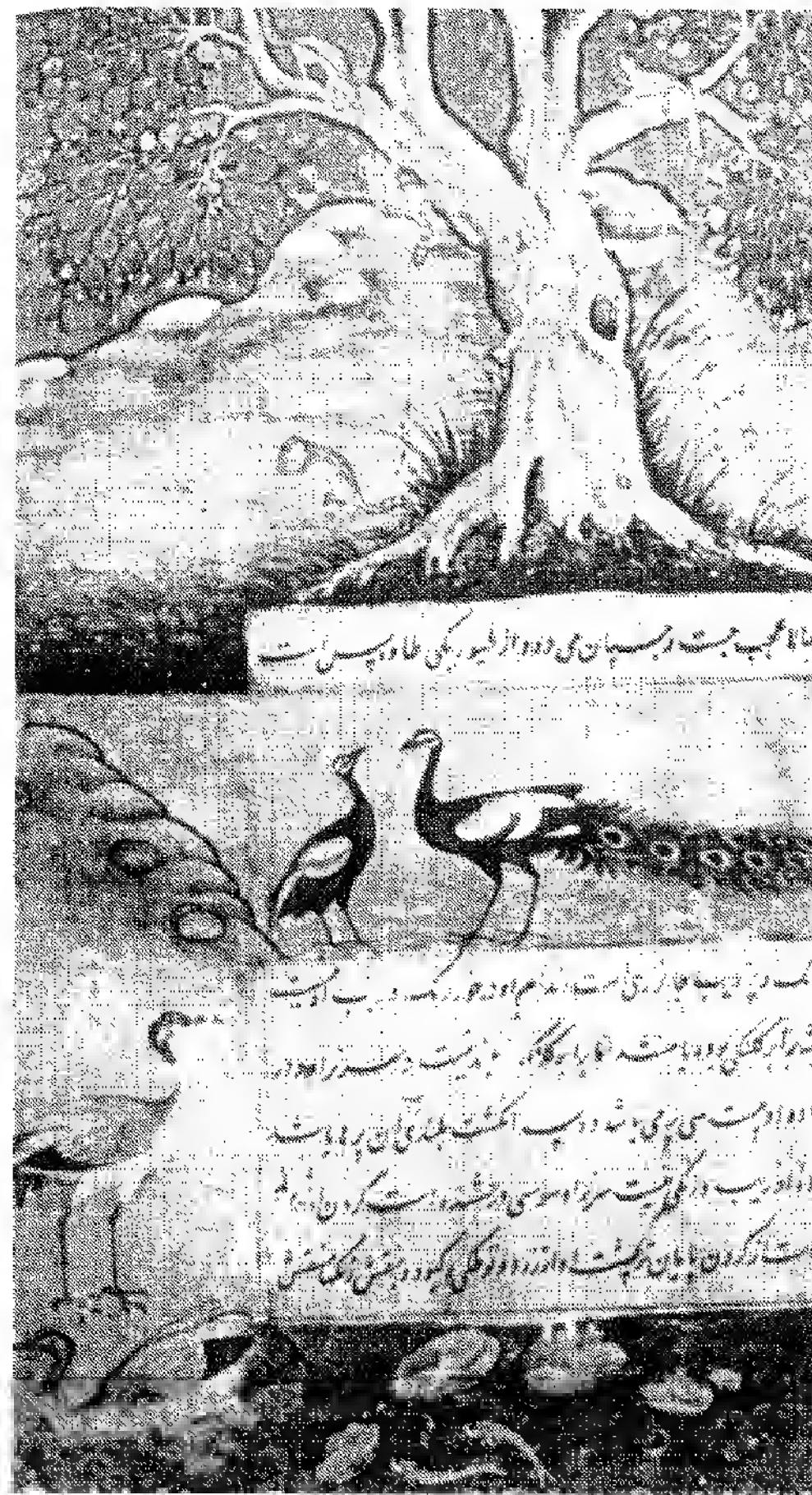


*Ostrich sitting on eggs from the Book of animals.*



in Arabic and Persian sources and gave his scientific observations on the animal kingdom. Al-Jahiz's aim of studying zoology is to demonstrate the existence of Allah and the wisdom inherited in His creation. He studied 350 animals that he described and classified in four categories together with their movements.

Al-Kindi and al-Farabi were also interested in zoology. They wrote several treatises on animals. In the 3<sup>rd</sup> AH / 9<sup>th</sup> CE, the most important work on zoology appeared in the work of Ibn Qutaybah entitled "*Uyum al-Akbar*" (The most essential information). Ibn Sina also devoted a section of his book, "*The*



*Birds from India from the Babur namah.*

*Shifa*", for animals. In Spain, Ibn Bajjah and Ibn Rusd were also interested in zoology and they produced important works in this field.

Al-Qazwani, in his cosmography, devoted a special section to animals. He divided the animal kingdom according to the animal's means of defence. Likewise there are also numerous scientists on zoology such as al-Dimashqi, al-Nuwayri, al-Jildaki in his *Durrat al-Ghawwas* (The pearl of the Pearl-Diver), Hamdallah Mustawfi and many others.

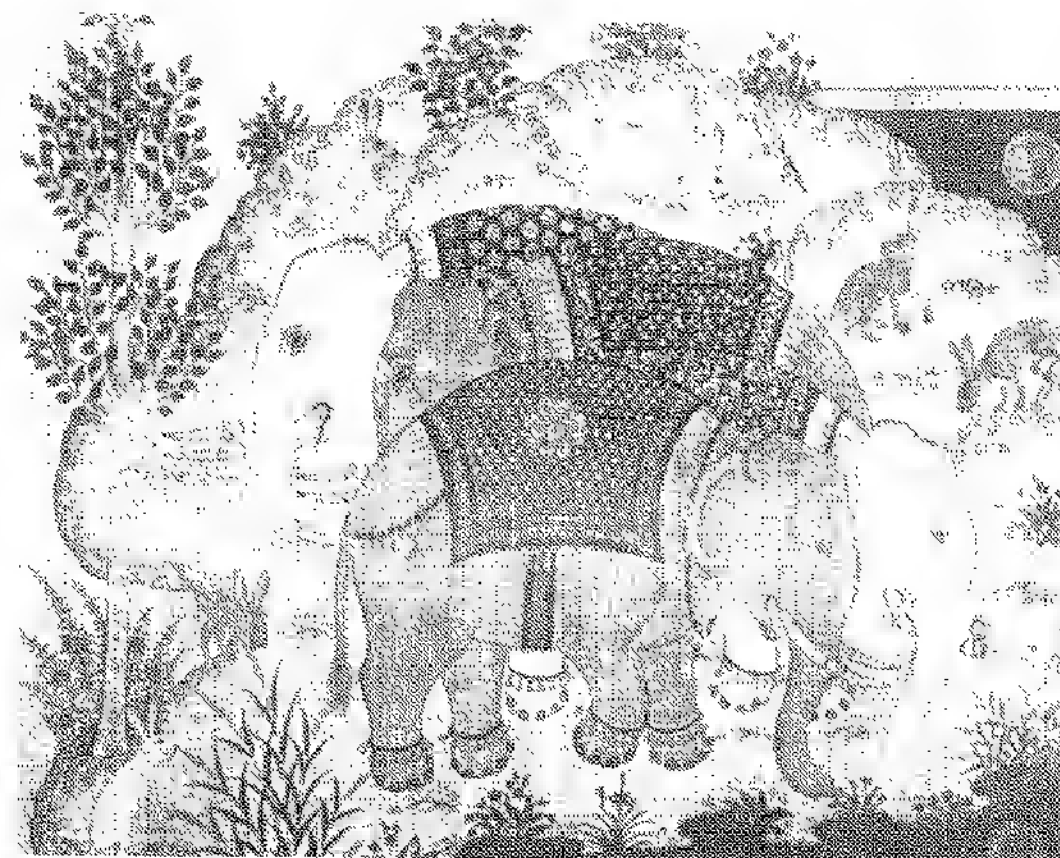


*Anatomical study of the horse.*

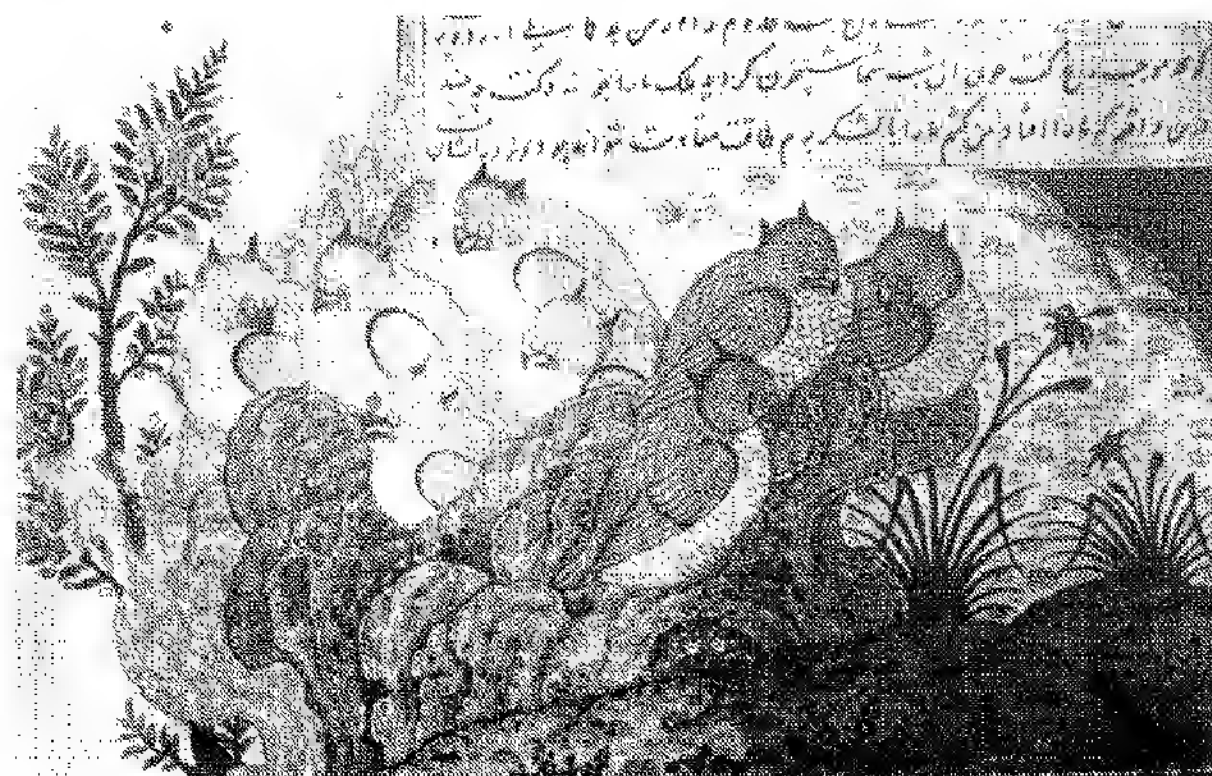




Scorpions from a treatise on natural history, the *Ikhtiyarat-I-badi* of Ali ibn Husayn.



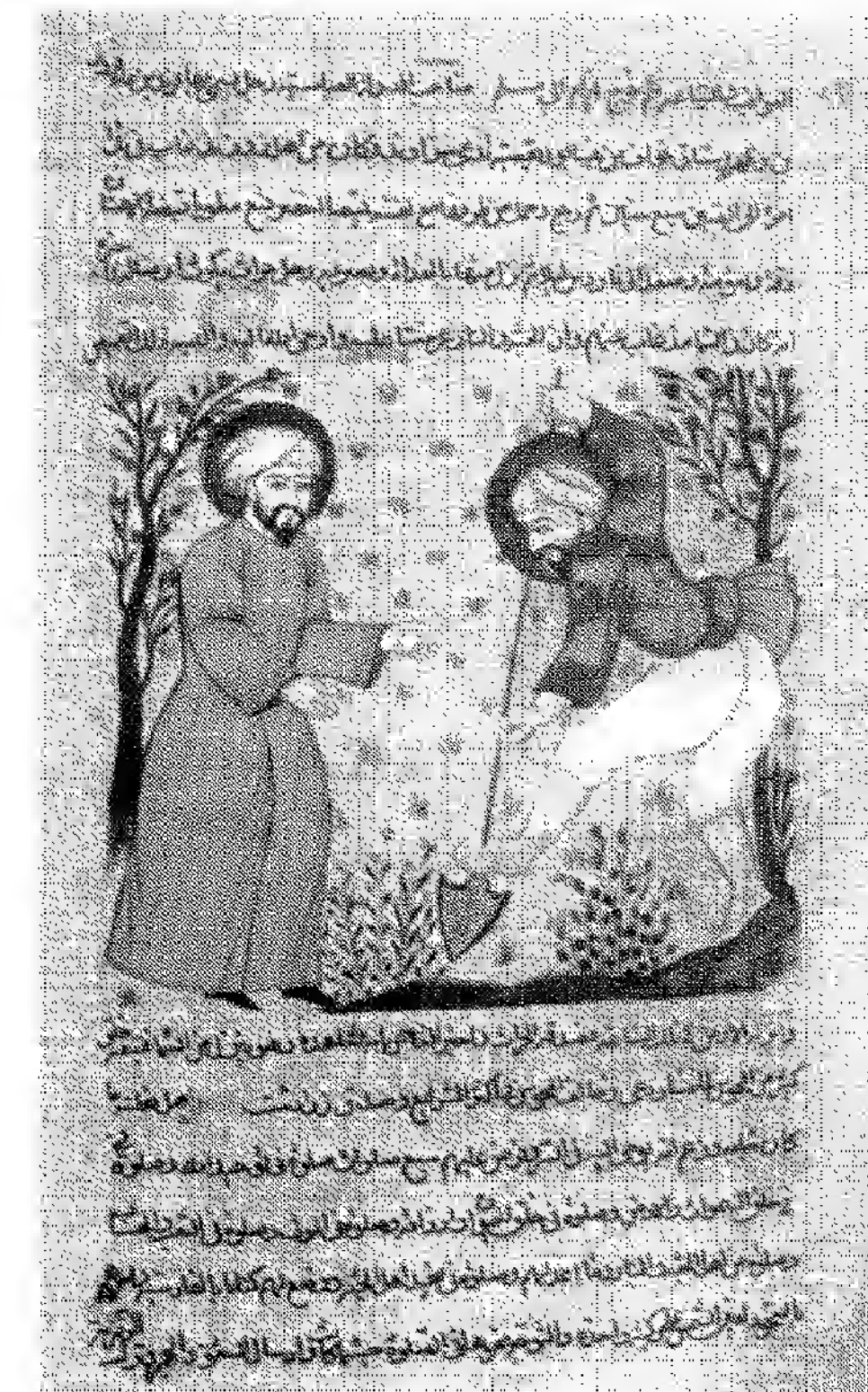
Elephants from the *Khalilah wa Dimnah*.



Owls from the *Kalilah wa Dimnah*.

## AGRICULTURE

*F*ilahah or Zira'ah, agriculture in Arabic, was recommended by the Shari'ah and was practiced by many eminent pious persons and scholars. Ali ibn Abi Talib (ra) was famous for his keen interest and activity in planting trees. Many prophetic



A sage encouraging a man to plantation.



traditions emphasizes on agriculture. According to a hadith, the Prophet ﷺ is reported to have said, *"It is blessed act to plant trees even if it be one day before the end of the world"*.

Muslims are heirs to the older religious teachings about agriculture, and the experience of millennia. These were found in all the earlier civilizations of western Asia and the Mediterranean world, including Egypt, Babylonians, Persia, Byzantium, Rome and even Yemen.

## IRRIGATION

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**I**n Egypt, Muslims inherited several millennium of experience in irrigation techniques. Some of these techniques are still intact to the present day. Improvement on these techniques like measuring the rise of water at Nile River are carried out. During the period of al-Mamun, a Nilometer, an apparatus for measuring water level in the Nile River, was built along the Nile.



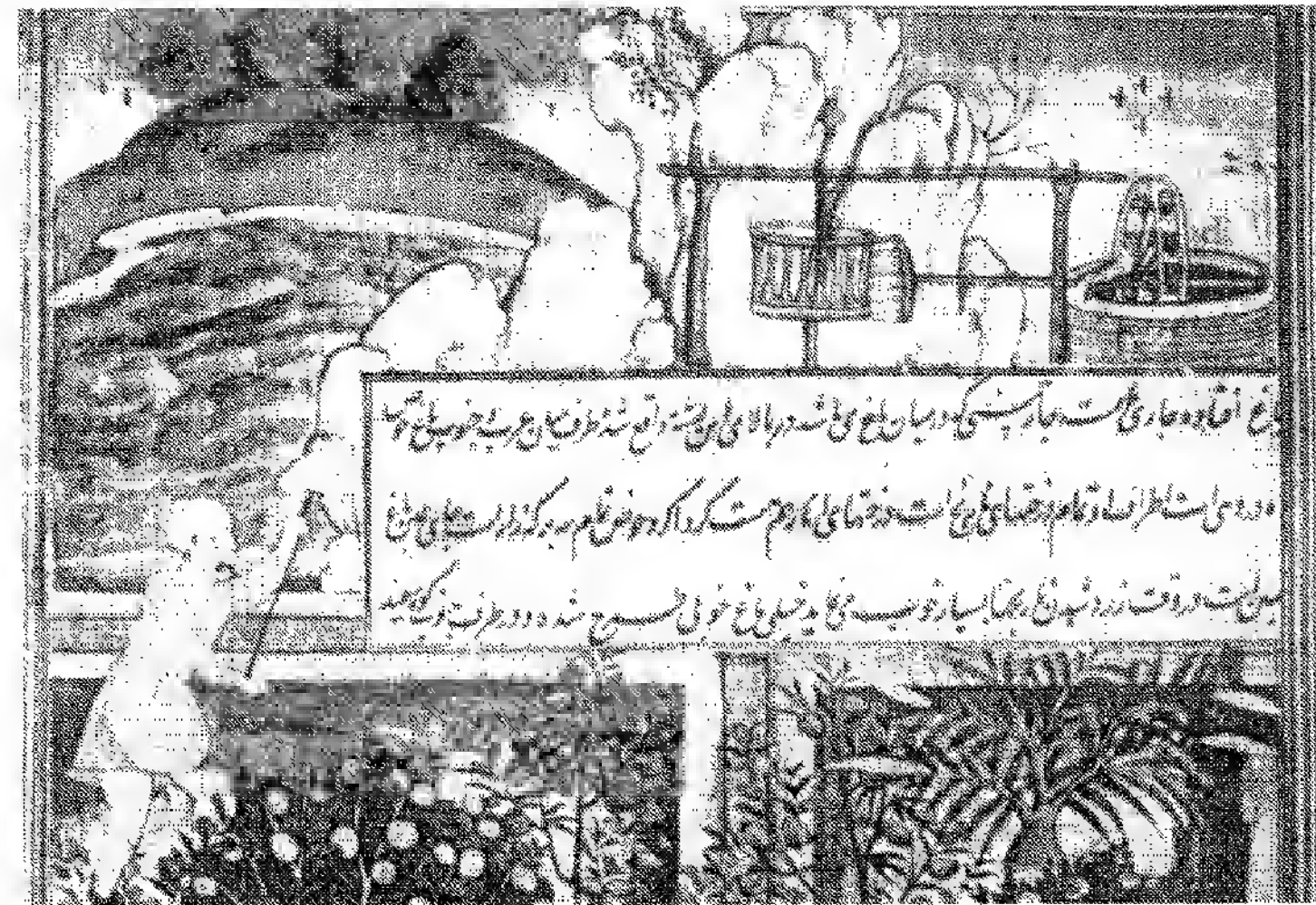
*One of the oldest surviving man-made reservoirs in the Islamic world.*



Al-Mutawakkil rebuilt this Nilometer over the ages with improved facilities and restored along the Nile. To this present day this technology continues to function. It is a reminder of the interest Muslim engineers and scientists in the Islamic World particularly Egypt.



*A reservoir near the city of Marrakesh.*



*A device to lift water from a well in India.*

## IN THE QUEST OF KNOWLEDGE

The above are few among the several works of treasures that Muslim world possessed. Unfortunately, today we, not only, turned a blind eye, but are not interested in the continuity of the treatises left by our Muslims predecessors. How many among us know the Muslim glories? How many among us know that the Muslims' technologies have been transferred to the west?

Do Muslims nowadays concern about these things? Muslims are wasting their time by creating havoc, never-ending debates and discussions among themselves. We are becoming the enemies of our own brothers, while the westerners are holding the torches of science. All sciences have their sources in the Qur'an and the prophetic traditions. Muslims paid great heed to every instruction and science communicated to them through the Qur'an and the prophetic traditions.

The greatest book ever revealed to mankind is Al-QUR'AN. Al-Qur'an weighs heavier than the whole world and the heavens put together. Despite possessing this miraculous book, we are hankering over disguised and trapped knowledge of Satan. Muslims have neglected the Qur'an and the prophetic traditions. Muslims are setting themselves on this illusive materialistic world. Our knowledge has become an instrument of the Satan. Muslims are left boundless in a world of corruption.

Rise! O! The chosen people of Allah ﷻ. Rise! O! The



inheritors of science. There is no treasure like knowledge. Rise! O! Worshippers of Powerful Allah ﷻ. By knowledge you are saved and by ignorance you are lost. All are not lost yet! The realm of knowledge has no bounds! Muslims still have the holy QUR'AN. Muslims still have the holy traditions.

But, the Muslims must have the burning desire to plunge into the ocean of knowledge. If Allah ﷻ wills, Muslims shall once again hold the torches of sciences. One of the most valuable sayings of the Prophet Muhammad ﷺ is that the pursuit of knowledge is incumbent upon all Muslims, male or female. It is adherence to this precious maxim caused the remarkable intellectual advancement in the Islamic world of the medieval age.

In another hadith, it was reported that an hour's pursuit of science is more valuable than attendance at the funeral of a thousand martyrs or offering prayers on a thousand successive nights. This is another proof in Islam to the special and emphatic injunction to the quest of scientific culture.

This injunction inspired the physician, Abul Abbas Ibnul Rumiya to search for a rare medical herb in the western world. He had trudged on foot from Spain to Egypt and to Syria. Similarly, Abul Mansur Rashiduddin Ibn Ali al-Suri left his country together with a painter. With the assistance of the painter, Abul Mansur was able to obtain the pictures of rare and valuable herbs.

The Botanist, Ziauddin Ibnul Baetar had traveled to Greece, Spain and Asia Minor in the pursuit of botanical lore. Even in the early period, botanical study and research had attained a state of perfection in the medieval world of Islam. This is rare even among the boasting pseudo-civilised nations of the present day.

European physician praised the Arab '*Materia Medica*'. In fact medical science of the west has failed. They would not solve the mystery of some curative secrets, which were known to the Arab masters of medieval age. The systematic study of science

and literature had not even begun in the rest of Europe, when Muslim in Spain has already reached a high degree of perfection in those branches of knowledge.

Students from France, Germany and England flocked to Spain in quest of knowledge. The physician of Andalusia, a fertile autonomous region in Spain, has rose to a high degree of skill in operative surgery. While women in Cordova, the capital of Spain, were experts in gynecology. Among countries in Europe, only Muslim Spain had the systematic study of history, philosophy and jurisprudence.

Muslims were the first to manufacture gunpowder and some Muslims in Spain were professionals in shipbuilding and fortification. The researches of MM, Reinaut, Casiri, Andres and Viardot have shown that the invention of gunpowder and an explosive substance for the propulsion of projectiles are attributed to the Arabs only.

It had been attributed to Roger Bacon as the very inventor of gunpowder. Roger Bacon had in fact reproduced as Albert Le Grand, the old recipes on this treatise. But by the discoveries of new manuscripts, new lights have been shed to show the world that it was the Arabs who have transformed the techniques of war by introducing fire weapons.

Historians had erred when they declared that it was in the battle of Crecy in 1346 that fire artillery was used for the first time. From old available manuscripts, various Arab authors proved that fire artillery was used before 1346. It was reported that in 1205 when Emir Yakoub besieged a rebellious chief in the city of Mahedra in Africa, he described the situation as,

*"Destroying his walls with various machines, engines, lightening...machines that we have never seen... which launch each 100 big jets and big stones fell down in the middle of the city and also jets of iron"*

This shows various machines and fire weapons had been



used well before 1356.

The arts of metallurgy, pottery, sculpture and irrigation were also creative sciences of the Muslims in Spain. The name of Abu Mansur, Babil Ibn Qurra and Ali al-Hasan are famous in world history. It was from Spain that the knowledge of mathematics and physical science was first imparted to the rest of Europe. The Muslims were the most expert physicians of Europe in the 9<sup>th</sup> to the 13<sup>th</sup> century.

The Muslims were also experts in Architecture. The expertise is shown in mosques of Cairo, Jerusalem, Taj Mahal and others. The prosperity of Babylon, Egypt and Persia was due to the adoption of advanced methods of agriculture. The Muslims were the first to introduce cotton and sugar-cane in Europe. They were also great experts in manufacture of glass and metal ware.

The Muslims were also the first to invent paper. They knew how to weave and dye cotton and silk goods. They were pioneers in geography. It was al-Mamun who established the first public library. The Royal Library of Cordova was famous in the world. It contained 600,000 volumes of books. In fact, St Louis of France imitated this library to build his first library in France.

The names of the fixed stars in the international scientific vocabulary and other words, which are found in Europe, are from Arabic words. This testifies the Arab's contribution in astronomy and their permanent place in world knowledge. A famous square in London and great citadel of British sea bore the Arabic name. 'Trafalgar' comes from two Arabic words *Taraf al-Ghar* (The cape of the cave), and 'Gibraltar' is from Arabic word *Jabal Tariq* (The Mount of Tariq). Tariq was the commander of the first Arabic armies to cross from North Africa to Spain. Indeed the map of Spain contains many Arabic names. Similarly, the names of many historic Spanish buildings are still in their original names given by the Arab builders.

*Alcazar* means 'the palace', and *Alhambra* means 'the red building'. Which English word could be more embedded in than

the word '*Admiral*'? Yet, this word is from the Arabic words *Amir al-Bahr* meaning 'Commander of Sea'. Algebra, algorism, zero, alchemy, chess, checkmate are other words from Arabic derivations. These only prove that the Arab's influence in mathematics, chemistry and the intellectual recreations of a civilized society have reached wide and far amidst the European intellectual circles. *AL* is the Arabic definite article and good many European words beginning with this combination of letters are descended from Arabic.

Another interesting borrowing is to be found in the French word '*salamalek*' which is from the Muslim greeting *Salamu Alaik* meaning 'Peace be on you'. The Arabic numerals and the decimal system were brought by the Muslims into the services of world civilization and handed over to Europe. English words derived from Arabic indicate the Arab influence in commerce, craftsmanship and agriculture. The word '*cheque*' comes from the Arabic word *Saqq*. This shows the Arab origin for many trading and financial transactions. These Arabic words survive to this very day.

The word 'Sofa' comes from Arabic word *Suf* meaning 'wool'. Whereas the word mattress comes from the Arabic word *Matrah* meaning 'the place where you lie down'. Words like Atlas, Damask, Lemon, rice, sugar, syrup and ginger are Arabic words. This indicates that the Arabs brought these articles to Europe. These and many more are canonical proofs to the Islamic greatness in the medieval age when Europe was in its infancy and was far away from the civilized world of the Muslims.

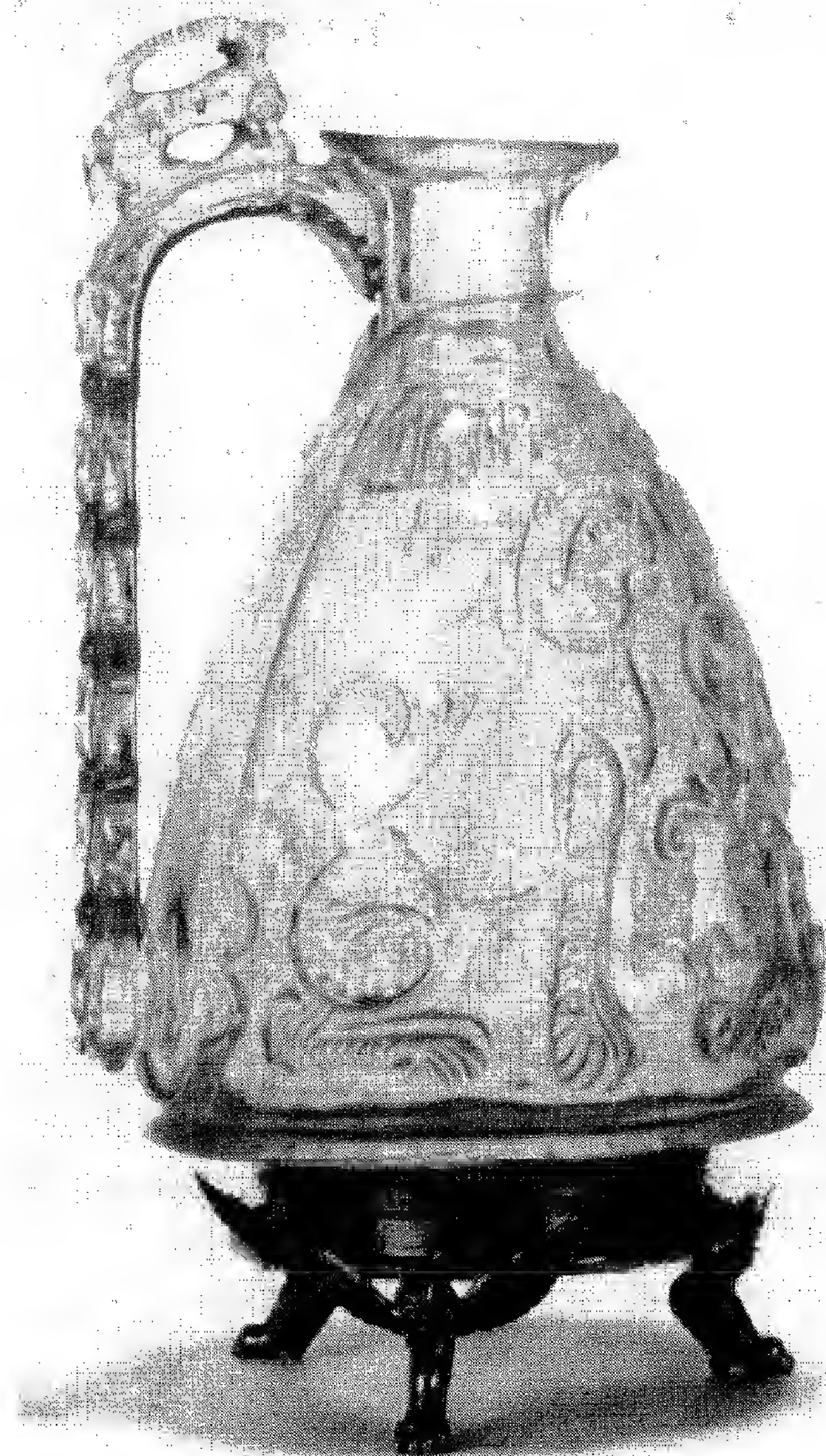
It is high time now! Time must not be wasted. Muslims must make an effort to catch up on the knowledge of the learned Muslims. Surprisingly, only about 25% of our Muslim scientists' manuscripts had been translated. There are about 75% of the unexplored manuscripts and important scientific treatises left to be translated. Let us pray to Allah ﷻ, the Almighty, to have a center or academy to translate, research and study the vast Muslim

scientific works that were left unexplored. It is hoped that once again Muslims shall overflow the world with knowledge as we have done for centuries. By the Power of Allah ﷻ, nothing is impossible!



*Blacas Ewer'. Islamic metal work. It exhibits many puzzling features. It is a squat multy-faced brass object. An inscription on the neck provides the following information: "Engraved by Shuja bin Ma'nah al-Mawsili in the blessed month of Rajab year 629 (1232) in Mosul." This ewer is one of the finest products of a school of metal workers that flourished in that Iraqi City.*





*Rock Crystal Ewer. Vessel made of Rock Crystal.  
This object was taken by Venetian when they looted  
Constantinople in 1204. It was part of the Fatimid treasure.*

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